

**Table 11. Average Headwater Elevation at S-174, S-176, S-331
Tailwater, Dry Season and Wet Season**

S-174	Dry Season	Wet Season
Year One	4.58	4.72
Year Two	4.14	4.82
Year Three	4.52	4.74
Year Four	4.47	4.86
S-176		
Year One	4.57	4.72
Year Two	4.12	4.79
Year Three	4.50	4.72
Year Four	4.40	4.81
S-331		
Year One	4.72	4.94
Year Two	4.30	5.04
Year Three	4.80	4.87
Year Four	4.68	5.09
L31N Average		
Year One	4.65	4.83
Year Two	4.21	4.92
Year Three	4.64	4.80
Year Four	4.55	4.95

NOTE: Year One = 1996
 Year Two = 1997
 Year Three = 1998
 Year Four = 1999

L-31 West Canal

L-31 WEST CANAL

L-31 West Canal (L-31W) Operation Objectives During Test 7

The L-31W canal stage, as measured at S-175 headwater, was maintained based on a weekly target stage computed from rainfall at the Homestead Field Station (SFWMD). The objective of using a rainfall stage relationship target was to simulate the response that marsh water levels would have had under historical conditions. Structures S-174 and S-175 and Pump Station S-332 were operated to maintain the target stage in L-31 W. Three electric pumps, added at S-332, increased the discharge capacity from 165 cfs to 465 cfs and replaced temporary diesel pumps used during Test 6. Pumping was restricted to 165 cfs during the Cape Sable Seaside Sparrow nesting season, January through June. The remainder of the year, pumping was allowed up to the maximum as long as the stage in L-31W canal was maintained at or above the target elevation. The monthly minimum delivery schedule for Taylor Slough was suspended during Test 7.

L-31 W Operational Criteria

The operational criteria for Test 7 is outlined in Table 4 (page 9). Figures 46 and 47 (pages 82 and 83) show the opening and closing criteria for S-174 and S-175.

Difference in Test 6 and Test 7 Criteria

Test 6 criteria for the L-31W canal required that a 4.5-ft stage be maintained during the wet season (June-October) and a 3.5-ft stage, lowered to 3.0 for 48 hours after a rainfall event, during the dry season. Test 7 allowed for a maximum stage of 4.7ft and a minimum of 3.0ft if the rainfall stage target was outside of those limits.

L-31W Summary of Operations

Wet Season 1995. Rainfall during June was heavy in South Dade and canals were operated according to flood control operations. During July maximum releases were made at S-332 and through S-175 in order to lower canal stages in L-31W in preparation for Tropical Storm *Chantal* and Hurricane *Erin*. Heavy rainfall associated with Hurricane *Erin* the first week in August and from Tropical Storm *Jerry* the last week in August resulted in flood control operations in the Test 7 study areas, including L-31W. Flood control pumping at S-331 and S-332 was maintained whenever there was downstream capacity. S-175 was open during this time to facilitate conveyance and at times flow at S-175 exceeded flow at S-174 due to additional local rainfall. WCA-2 and WCA-3 were all above schedule during this time. Lake Okeechobee and WCA-1 were above schedule during October and were declining going into the start of Test 7.

Year One Test 7. Beginning in November 1996 the Corps of Engineers and Everglades National Park began using the rainfall based delivery model detailed in Appendix B of the Test 7 EA. Figure 48 (page 84) shows the calculated or target stage plotted against the S-175 headwater stage for Year One of Test 7. The lines at 4.7ft and 3.0 ft indicate the maximum and minimum operational range for L-31W. Figure 49 (page 85) shows the average daily headwater and tailwater levels for Year One Test 7 for S-174. The target stage was above the 4.7ft maximum until the third week in November. The target stage continued to decline but the actual canal stages

remained above the target due to high stages in L-31N from pumping at S-331 and discharges through S-173 until December 11, 1995. Also during this time, S-174 and S-175 were open and pumping at S-332 was 300 to 400 cfs. The U.S. Fish and Wildlife Service Endangered Species Act Biological Opinion and limited the pumping at S-332 to 164 cfs during the nesting period of the Cape Sable Seaside Sparrow, January through June. This constraint on pumping, at times, limited the ability to maintain the target stage. Minimized pumping at S-332 accounted for the opening of S-175 from January 3 through January 9, in an effort to maintain the stage in L-31W below 4.7. A temporary deviation was discussed on January 12, 1996 to prepare for the proposed L-31W drawdown test scheduled for January 22, 1996. S-175 was closed, S-174 remained open with an average daily discharge of 150 cfs and S-332 continued to pump approximately 100 cfs (average daily). The stage in L-31W was maintained at 3.4 ft-NGVD.

Beginning on January 22, and ending on January 31, a temporary drawdown test began in order to develop a model of groundwater level responses to operation of L-31W Canal. The following outlines the temporary drawdown test:

- January 22, 1996
 - S-177 automatic settings to 3.9 ft, 3.8 ft
 - Close S-174
 - Open S-175 stepwise for flow measurement by USGS to full open
 - After consultation among USACE, ENP, and SFWMD, turn on additional pumps at S-332 as needed to reach target 3.0ft in L-31W canal.
- January 23-30, 1996
 - Hold L-31W canal steady at 3.0ft with adjustment to S-332 and S-175
- January 25, 1996 Test modifications per SFWMD were requested as follows:
 - G-211 Headwater of 5.0 to 5.5 ft
 - S-176 Headwater of 4.0 to 4.5 ft
 - S-177 Desired headwater of approximately 3.7 ft
 - S-332 pumping may increase above 300 cfs but only to maintain L-31 stage
- January 31, 1996
 - Reduce pumping to 165 cfs max. at S-332
 - Open S-174 stepwise for USGS flow measurement to full open
 - Close S-175 stepwise for USGS flow measurement to full closed
 - Return S-174, S-175, and S-177 automatic settings to normal
 - Resume maintaining current target level to extent possible under pre-test restrictions.

The drawdown test proceeded as outlined and operations were returned to the Test 7 criteria January 31, 1996. The stage in L-31W gradually returned to close to 3.0 ft by February 12, as the target was below the 3.0-ft minimum.

February through March the computed target stage was below the minimum criteria of 3.0 ft-NGVD. Coordination was held between the Corps of Engineers, SFWMD, and Everglades National Park concerning opening structure S-174 to bring the water levels in L-31W back up to the

minimum of 3.0ft by transferring water from WCA-3A through L-30 and by opening G-211. It was noted that this operational decision may reduce the ability to maintain stages north of S-174/S-176 at optimum levels.

In April the USFWS contacted the USACE concerning the pumping at S-332 being in excess of the 165 cfs stated in the Test Iteration 7 Operating Criteria. The appearance of excess pumping was due to the use of the USGS rating of the pumps, which calculated a combined pump discharge of the 193.9-cfs for pumps 1 through 6. The pump curves used in the original design of the pump stations show a value of 165 cfs for pumps 1 through 6. To avoid any appearance of operating outside of the criteria, Pump 6 was turned off which resulted in a computed flow of 156 cfs. The USGS rating curve was provided to the SFWMD operations office to be used by both the SFWMD and the Corps of Engineers in fall future flow computations at S-332.

During May the water levels in the marsh areas around the L-31W canal began to rise in response to several locally heavy rainfall events. The rainfall stage model did not reflect the corresponding rise in marsh levels but remained below 3.0 ft. Of main concern during May was the completion of the second nesting cycle of the Cape Sable Seaside Sparrow population to the south of S-175. During this month the Corps of Engineers consulted with Everglades National Park, Fish and Wildlife, and SFWMD prior to making operational changes in L-31W Canal. Structures S-174 and S-176 were triggered open and pumping at S-332 was increased to 165 cfs as per the Test 7 operating criteria. Due to continuing rainfall, it was decided that S-174 should be closed in an effort to prevent S-175 from opening and increasing water levels in critical Cape Sable Sparrow habitat to the south. The water was routed through S-176 to C-111 if the headwater stage at S-176 exceeded 5.0ft-NGVD and pumping continued at S-332 up to 165 cfs to return the L-31W stage to 3.0 ft. Once the stage in L-31W returned to 3.0 ft, pumping at S-332 was cut back and S-174 was operated as per the Test 7 operating criteria.

The following temporary operation for pumping at S-332 was agreed upon. The need for concern was based on marsh levels west of L-31W Canal being at 4.5 ft, and the need to reduce flows downstream of S-175 in the critical Cape Sable Sparrow habitat.

- Operate S-332 in the following manner:

- When the headwater stage at S-175 is above 4.0 ft pump 165 cfs
 - When the headwater stage at S-175 is between 4.0-3.5 ft pump 100 cfs
 - When the headwater stage at S-175 is between 3.5 ft-3.0 ft pump 50 cfs
 - When the headwater stage at S-175 is at 3.0ft- pump 10 cfs

- S-174 will remain closed until the headwater stage at S-175 is at 3.0 ft then will open as per the Test 7 Operating criteria to maintain the stage in L-31W at 3.0 ft.

By the end of May and the beginning of June, according to biologists at ENP, the Cape Sable Seaside Sparrows nesting to the south of S-175 still needed two to three weeks to complete the second nesting cycle. The model target stage was below the minimum of 3.0 ft-NGVD. In early June there was some locally heavy rainfall. During the week of June 12, in a phone conference between USFW, ENP, SFWMD, USACE, a decision was reached that in addition to the previous modification to criteria in May that pumping at S-332 should be increased above the

165 cfs, in order to avoid opening S-175 and possibly affecting a sub-population of nesting Sparrow south of S-175. On June 21, the operating criteria at S-174 and S-176 which were modified in May (S-176 set to open before S-174, to avoid the opening of S-175) reverted back to the criteria whereby S-174 was set to open when the headwater exceeds 4.85ft and closes at 4.65 ft, and S-176 opens when the headwater exceeds 5.0ft and closes at 4.75 ft. The L-31W Canal stage followed the target closely until the third week of September when the model target exceeded the maximum criteria, and therefore the stage was maintained below the 4.7ft maximum. By the end of the month, the target was 4.6 ft. S-174 opened September 11, when headwater reached 4.85ft and remained open. October began with locally heavy rainfall and was followed by rainfall associated with Hurricane *Lili*. Operations were modified to prepare the C-111 basin for the potential of Hurricane *Lili* becoming a Category III event and possible hitting South Florida. On October 12, the S-176 Headwater was 4.97ft and the gate began to open. S-175 began to open at 1900 on October 12, when the headwater reached 4.69ft and remained open. S-332 had been pumping at or near maximum since October 7. The L-31W structures were operated within the Test 7 criteria; stage as measured at S-175 headwater stayed within the Test 7 range.

Year Two Test 7. Year Two Test 7 at S-174 began with a headwater stage of 4.65 ft, which is close to the maximum criteria. The head dropped below that level and remained there through May. From May through October the headwater level was between 4.65 ft and elevations just above 4.85 ft. There was a significant rainfall even in June (see Figure 50, page 86). See Figure 51 (page 87) for S-174 flows.

During November pumping at S-332 diminished to its minimum requirement and remained at the minimum through January 13 when pumping was increased to maintain L-31N at its target level due to rainfall. Pumping rates through April were in the low range but increased to moderate in May. Rainfall brought the water level in L-31 W to a high level in the second half of May and the target level was raised to 4.5 ft in the last week of the month. In June and July S-332 pumping varied between maximum capacity and minimum requirement depending on the target level of 4.5 ft. Pumping at S-332 was stopped and S-174 closed on September 30 to facilitate S-332D construction (see Figure 52, page 88).

S-175 began November at just over headwater stage of 4.5 ft. The stage level declined from this level downward to 3.0 ft by the end of December and remained at that level through the first one-third of May. Stage levels then begin to climb and leveled out in mid-June at about 4.5 ft. The stage level remained above 4.5 ft but below 4.7 ft with exception of a rainfall related blimp on October 1 (see Figure 53, page 89). Flows through S-175 were minimal for the hydrologic year but the amount of flow that did occur took place in the wet season (see Figure 54, page 90).

Year Three Test 7. Year Three Test 7 started the year at a headwater stage level of 4.65 ft in November at S-174 (Figure 55, page 91). Since Year Three was a wet year, stage levels stayed in the 4.5 to 5.0 ft range all year except April and May when the stage level dropped to 4.0 ft. See Figure 56 (page 92) for S-174 flows.

Pumping at S-332 was at the minimum requirement of 10 cfs during the first half of the month. L-31W declined below its schedule. On November 17 the USGS began conducting a test in C-111 to evaluate methyl bromide concentrations in ground water levels. Water level in L-31W

was maintained at or below its target stage in order to offset effects on groundwater level as a result of the test. After the test ended on November 20, the district started to make water supply releases through S-12C. In December pumping at S-332 was from moderate to maximum. Beginning in January and going through April pumping at S-332 was limited to 165 cfs minimum to save the Cape Sable Seaside Sparrow. Pumping at S-332 was reduced according to the amount of water available, May through July. In August pumping at S-322 changed and varied from high to minimum during the month according to operational guidelines. Due to Hurricane *George*, operational guidelines were deviated from normal guideline, temporarily. Pumping at S-322 decreased in the second half of October due to decreasing inflows (see Figure 57, page 93).

The Year Three Test 7 headwater varied more in this year than the previous. The headwater varied from about 4.60 ft to below 3.5 ft. Discharge from S-175 corresponds to the higher stage levels in the dry season and the August rainfall spike (see figures 58 and 59, pages 94 and 95).

Year Four Test 7. Year Four Test 7 headwater for S-174 was very consistent in the first three months of the dry season and the wet season. The stage level in November, December, January and half of February varied very little and was maintained between elevations 4.85 ft and 4.65 ft. The second half of February, March, April, and May the headwater level dropped but by the end of May was back to the level experienced in the early dry season. The stage level varied a little more in the wet season but the magnitude was in a range of 0.1 to 0.2 ft. A major event in October produced a headwater level that neared 7.0 ft (see Figure 60, page 96). For S-174 flows see Figure 61, page 97.

Flow at S-332 shows two fairly substantial flows in the dry season, November and January through mid-February (see Figure 62, page 98). There was minimum flow from mid-February to June 1. From June through October there are substantial flows. The district made flood control pumping 24 hours a day including emergency flood control pumping at S-332D. The test of S-332D pumping was completed on September 27.

S-175 was within the operating criteria as the hydrologic year began. In December the headwater level receded below 3.5 ft until just after the first of January when the stage rose sharply to 4.5 ft. Stage level remained at that level through the month of January and then fell sharply. During February, March, and April the stage level was near 3.0 ft. In May the stage level began to rise and was back within the operating stage criteria by June 1. Stage levels were for the most part in the range of the operating stage criteria throughout the wet season. The exception was two events of significant rainfall in September and October (see Figure 63, page 99). Flow through S-175 was again minimal in the dry season with some flow in early November, January and some in February. The primary flows occurred in the wet season (Figure 64, page 100).

L-31W Analysis of Operations

Restoration of natural flow through Taylor Slough has been linked to improving water levels in L-31W rather than increasing pumping from L-31W via pump station S-332. A rainfall/stage relationship was developed from analysis of the historical relationship between rainfall at the Homestead Experiment Station and the stage at S-196A for the period 1933-1945. The relationship between S-196A and the stage at Taylor Slough Bridge was then established using the time period 1961-1965. The primary goal of using a rainfall based delivery model is to simulate the response

that marsh water levels would have had under historical conditions (Van Lent 1994). This analysis was developed further into a statistical model of the relationship between the rainfall at Homestead Field Station rainfall was chosen due to the discontinuation of the Homestead Experimental Station record after Hurricane *Andrew*. The model is run on a weekly basis and adjustments to pumping at S-332 and operation of S-174 and S-175 are made accordingly in order to maintain the target state in L-31W. The design water levels for the L-31W Canal were 4.5 ft-NGVD with a water level of 3.0ft prompting water delivery. For Test 7, the maximum headwater stage at S-175 was set at 4.7ft and the minimum set at 3.0 ft. Figure 48 (page 84) shows the target stage in L-31W with the Homestead Field Station rain gage and the model target stage for both the 1933-1945 and 1970-1982 period and the maximum and minimum range.

The original analysis of a rainfall stage relationship was calibrated based on a time period from 1933 through 1945 and verified using data from 1946 through 1958. (Van Lent, 1993). The model actually used for Year One of Test 7 is based on the correlation between L-31W stage and rainfall and was developed based on a time period from 1970-1982. Figure 48 (page 84) indicates that the L-31W Canal stage actually followed the 1933-1945 model more closely. This was coincidental, however the hydrograph (Figure 66, page 102) of the model for 1933-1945 against the model for 1970-1982 and various water level gages to the east and west of L-31 W indicates that the stage at Taylor Slough was also more closely associated with the earlier time period for the rainfall during Year One of Test 7.

The hydrographs also indicate that the model really does not correlate the state in L-31W with the water levels in the marsh to the west of L-31W. A higher minimum stage in L-31W may be better able to maintain a longer hydroperiod in the marsh to the west of L-31W. The historical water levels at Taylor Slough Bridge fluctuated between surface water and groundwater (gse 3.5 ft). Phase II operations will be augmented by pump station S-332D (500 cfs capacity) adjacent to S-174 and the criteria states that no upper L-31W canal stage limit will be imposed, this still would not address the lower stages indicated by the models. This will have to be studied further. The historical relationship between S-196A and water levels at Taylor Slough Bridge were established in the development of the rainfall stage model, but this relationship may not be enough to predicate an elevation in L-31W canal to return marsh hydroperiods to historical trends.

The stage in L-31W was maintained between the minimum and maximum criteria for the most part through Year One. Higher stages than were indicated by the model for the last week in November and the first week of December were a result of pumping at S-331 due to the trigger well criteria at Angels well. The stages in L-31N triggered the opening of S-174 through the third week of December 1995. Once S-174 flow decreased the pumping at S-332 was sufficient to begin following the model target stage. Marsh gages to the west of L-31W and indicate that higher stages were maintained at the onset of the dry season. The time window for this figure has been expanded to include the 1995 wet season, thus showing the antecedent conditions. These hydrographs also indicate that any residual water storage from a rainfall event is rapidly removed once the target stage is 3.0 ft-NGVD, or less in the L-31W Canal (mid-January through mid-June). Figures 66, 67, 68, and 69 (pages 102, 103, 104, and 105) show stage levels for each of the four years of Test 7 for marsh gages to the west of L-31W.

Had the lower limit of the rainfall stage model been followed, the gradient to the east due to the lowering of L-31W stages would have exceeded past trends indicated by Everglades National

Park research (Test 6 analysis). This further indicates that the low end of the rainfall stage model, though it may have been the historical trend in the marsh gages, may not be appropriate for predicating an adequate L-31W Canal stage.

Table 12 (page 106) is a tabulation of average monthly stage levels for S-174 for the four years of Test 7. The table also provides the annual dry and wet season average stage level for each of the years. This data has been discussed in previous sections. Major observation is the minimal variation in average monthly stages. Table 13 (page 106) provides average month, dry season and wet season stage levels for S-175 headwater. Average dry season was between 3.2 and 4.2 ft. The average wet season was between 4.1 and 4.6 ft. Table 14 (page 107) provides average monthly stage levels plus the dry and wet season averages for S-196 for each of the four years in Test 7. This gage is located on the east side of L-31W. The average levels for the dry season are between 3.0 and 3.7 ft. For the wet season the range is 3.9 to 4.5 ft. Table 15 (page 108) provides data for three gages on the west side of L-31W. They are NP-206, R-3110, and Rutzke. NP-206 is directly south of L-67 Ext. and is located seven miles due west of L-31N. R-3110 is located west of L-31W 2.5 miles, and Rutzke is located less than one mile west of L-31N and just south of the NP-206 longitude. NP-206 shows the higher average stage levels, dry and wet compared to the other gages. The two gages nearest L-31N and L-31W are about more than 1.0 ft lower in the dry season and almost a foot lower in the wet season. A computation was made using annual flows at S-174 and flows at S-176 for three of the four years of Test 7. Year One was listed in the Executive Summary of the referenced Year One monitoring report. That statement was that two-thirds of the flow delivered by L-31N was diverted to Taylor Slough. The computation of S-174 and S-176 was to determine the percentage through S-174 compared to S-176. The percentage was less than the Year One two-thirds. The percentages computed were 48.5 percent, 52.7 percent, and 48.9 percent, respectively for Years Two, Three, and Four. These figures should probably be closer to two-thirds.

Figure 46. S-174 Flow, Year One, Test 7

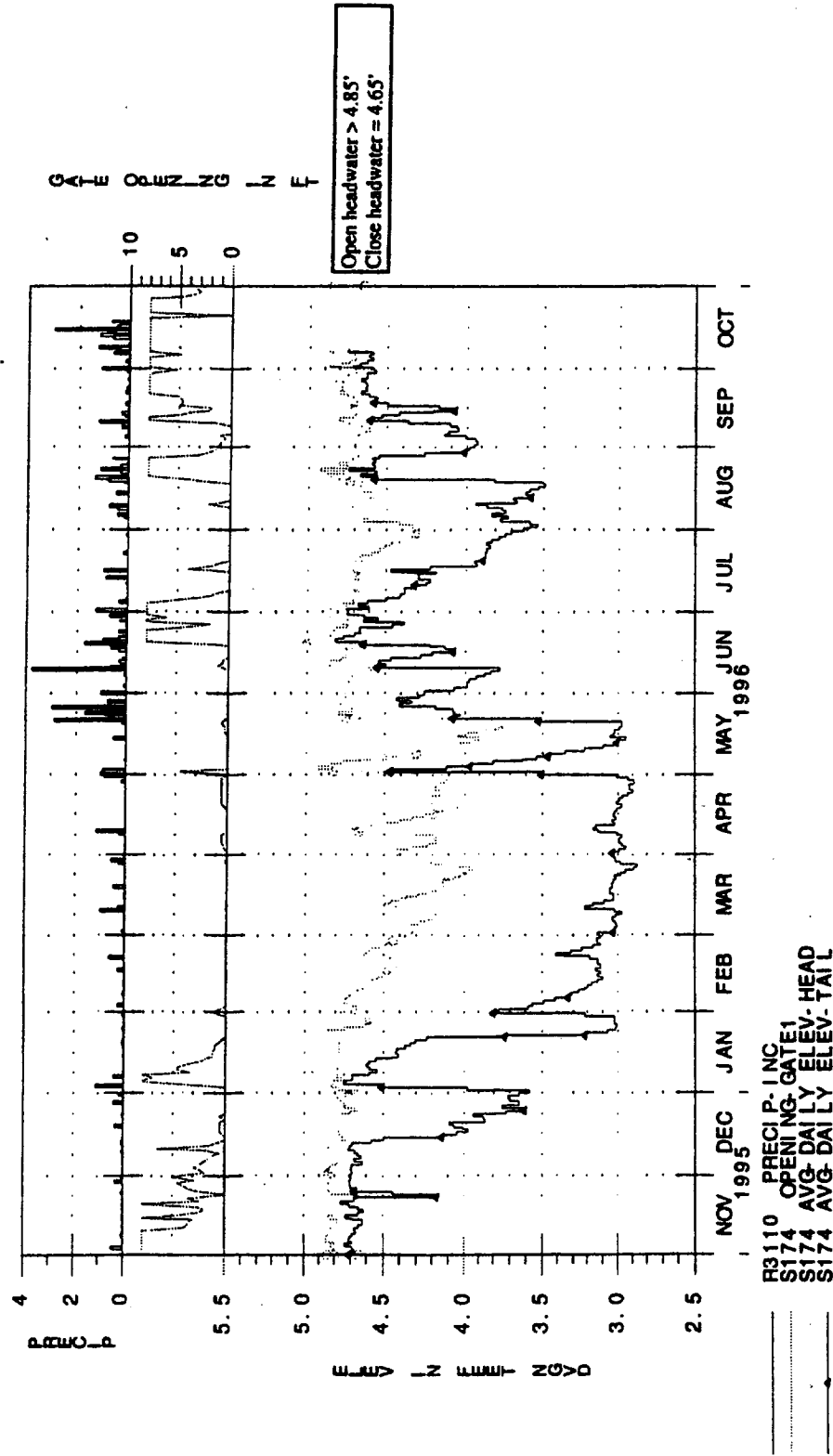


Figure 47. S-175 Average Daily Headwater/Tailwater Levels, Year one Test 7

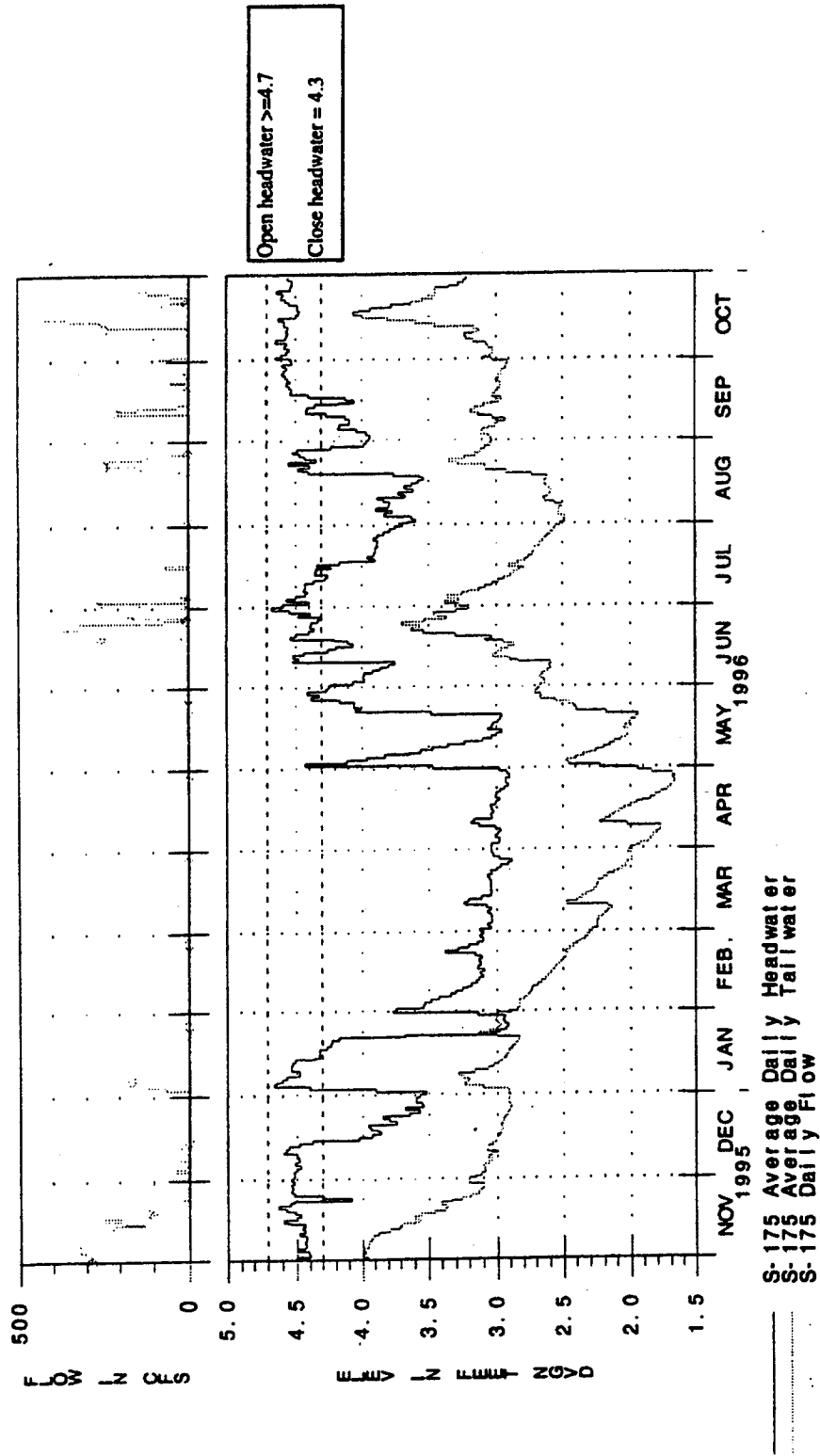


Figure 48. L-31W Target Stage 1933-1945 vs. 1970 vs. S-175 Average Daily Headwater Stage

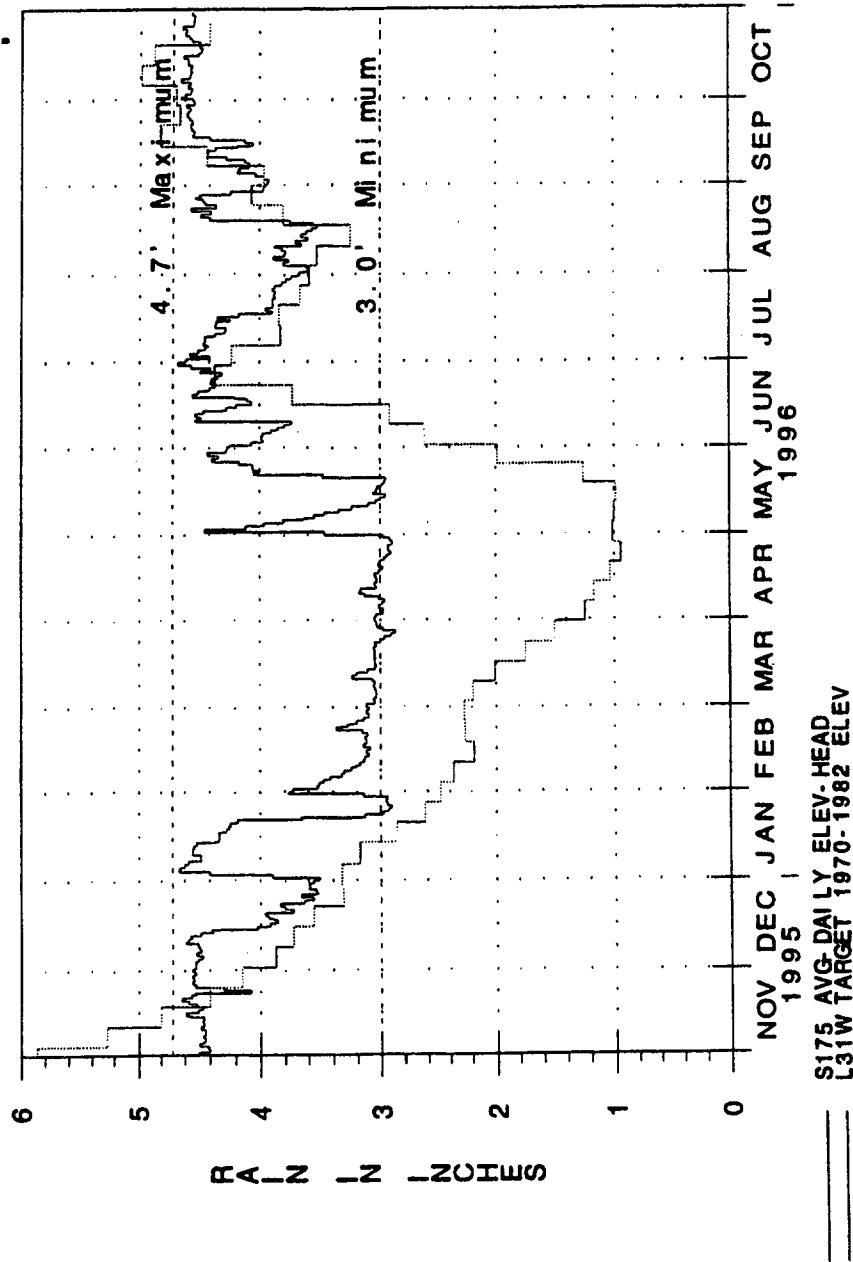


Figure 49. S-174 Ave. Daily Headwater/Tailwater Level, Year One Test 7

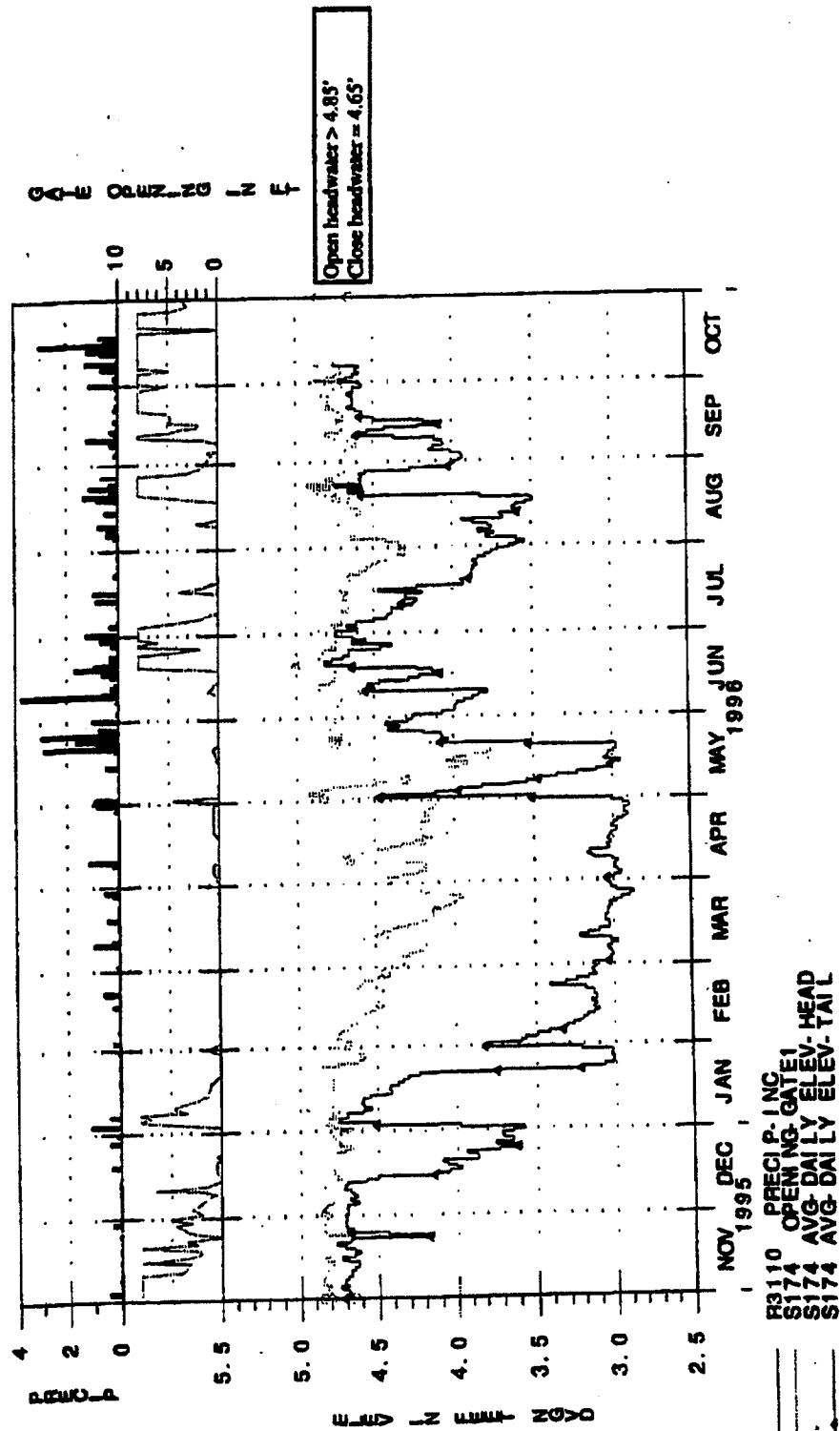


Figure 50. S-174 Ave. Daily Headwater/Tailwater Level, Year Two Test 7

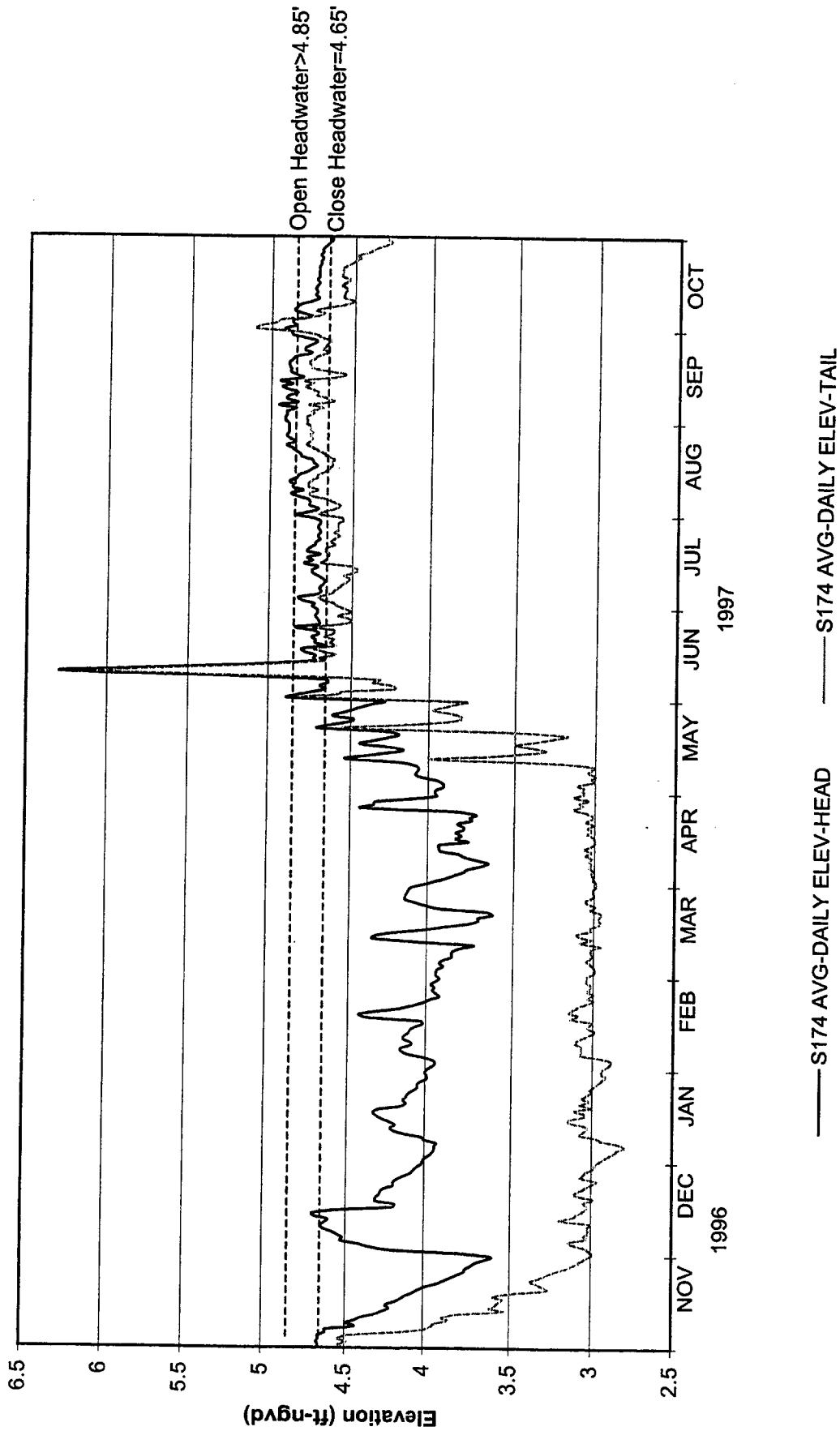


Figure 51. S-174 Flow, Year Two Test 7

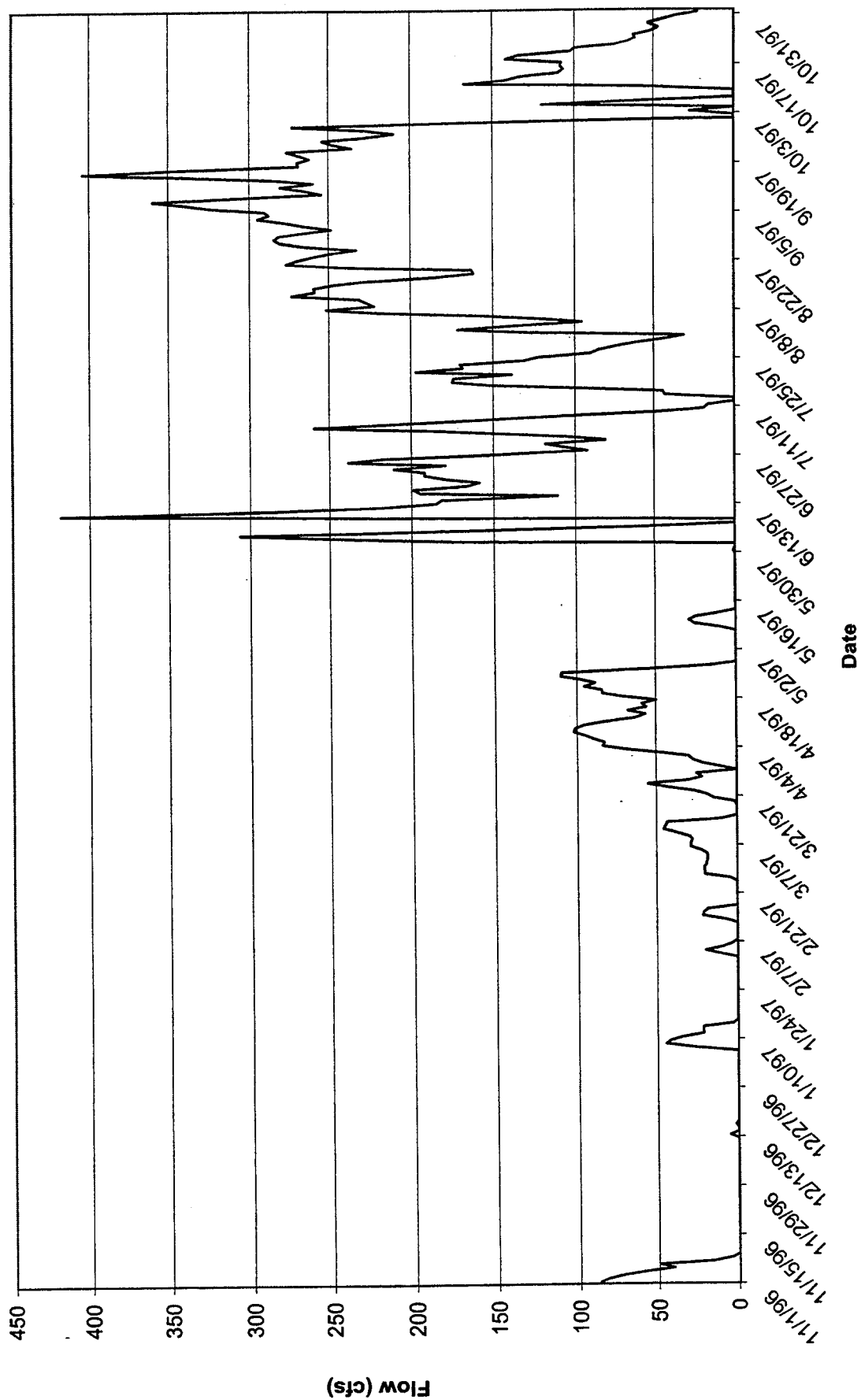


Figure 52. S-232 Flow, Year Two Test 7

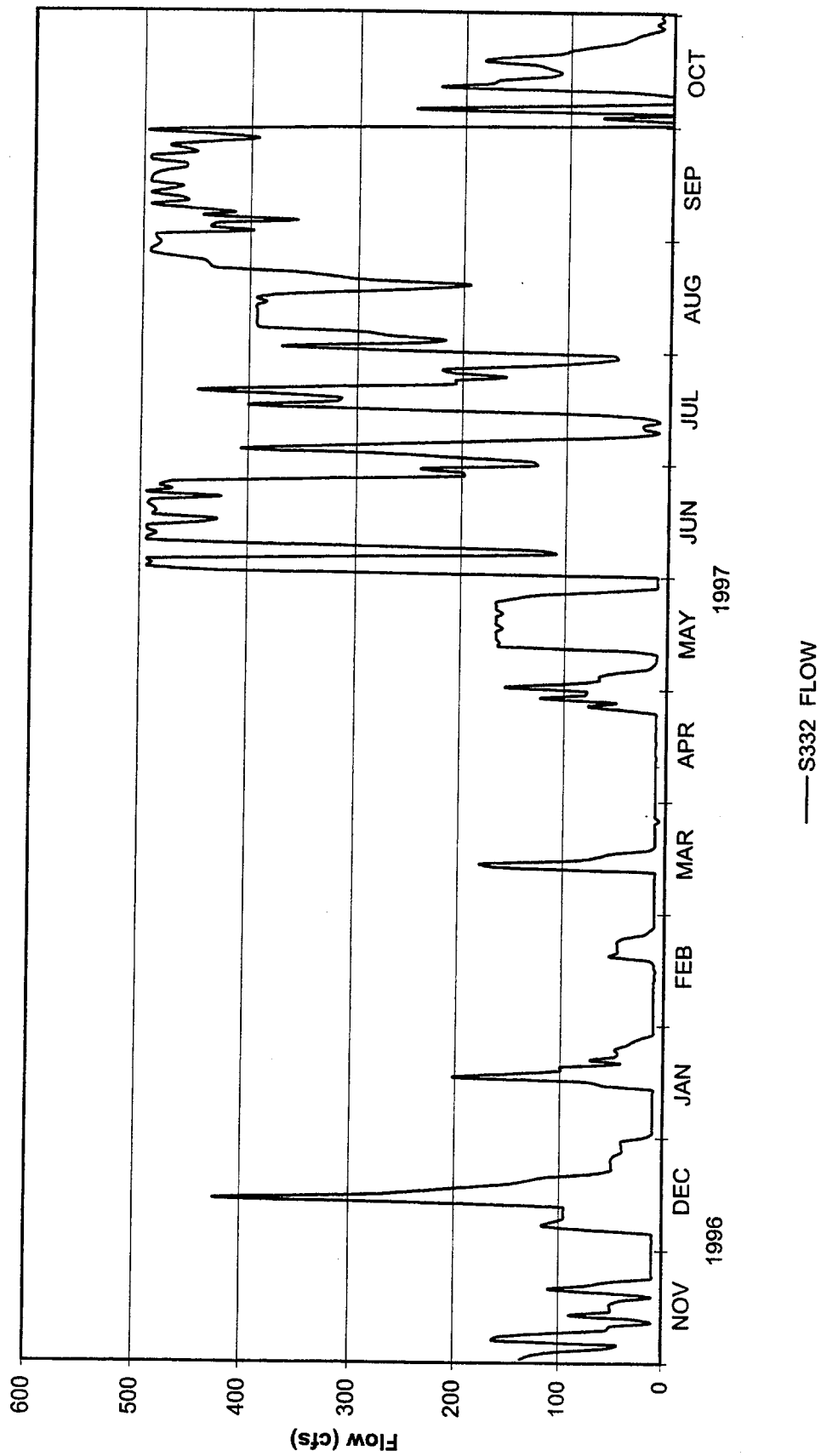


Figure 53. S-175 Ave. Daily Headwater/Tailwater Levels, Year Two Test 7

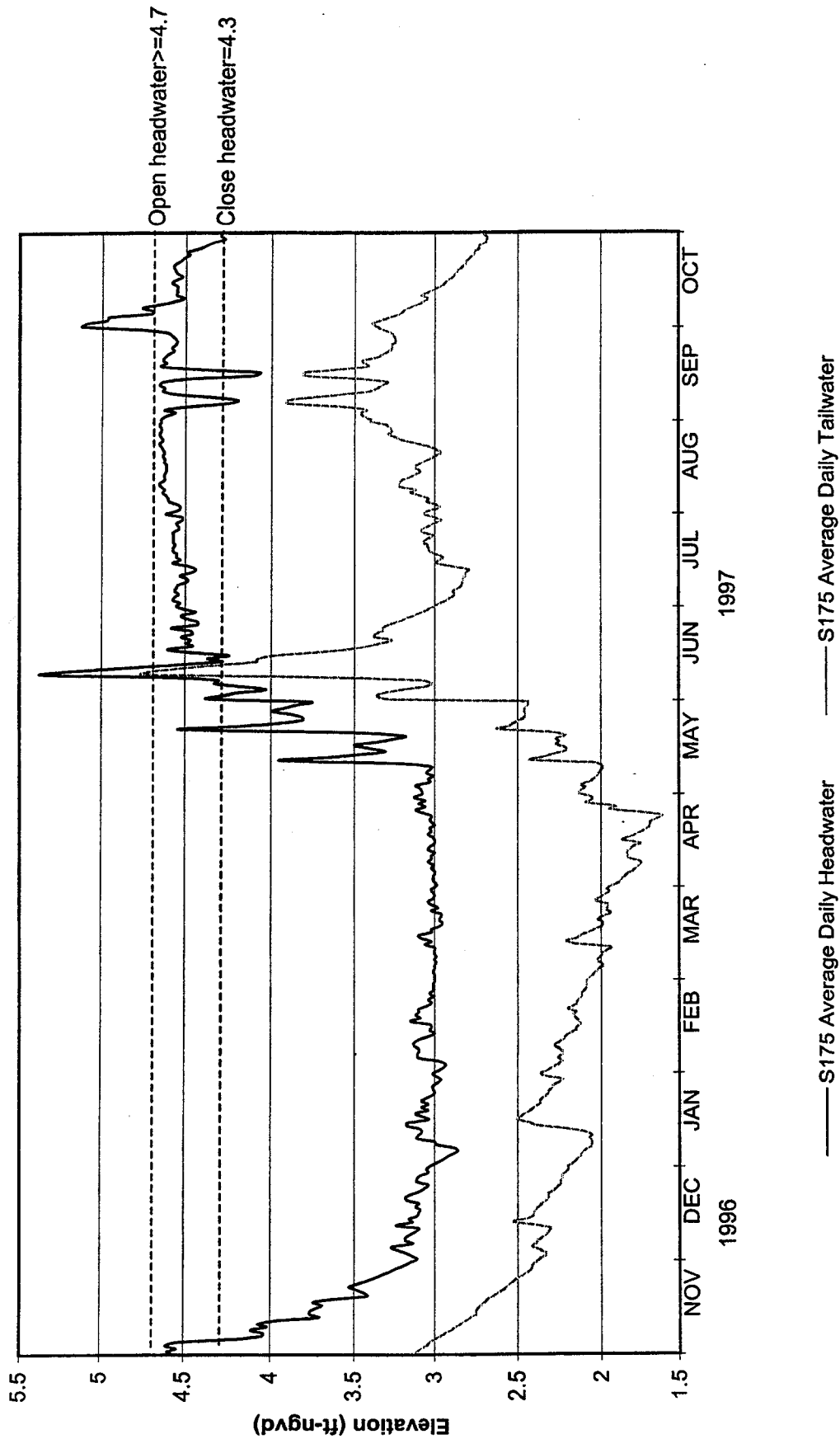


Figure 54. S-175 Flows, Year Two Test 7

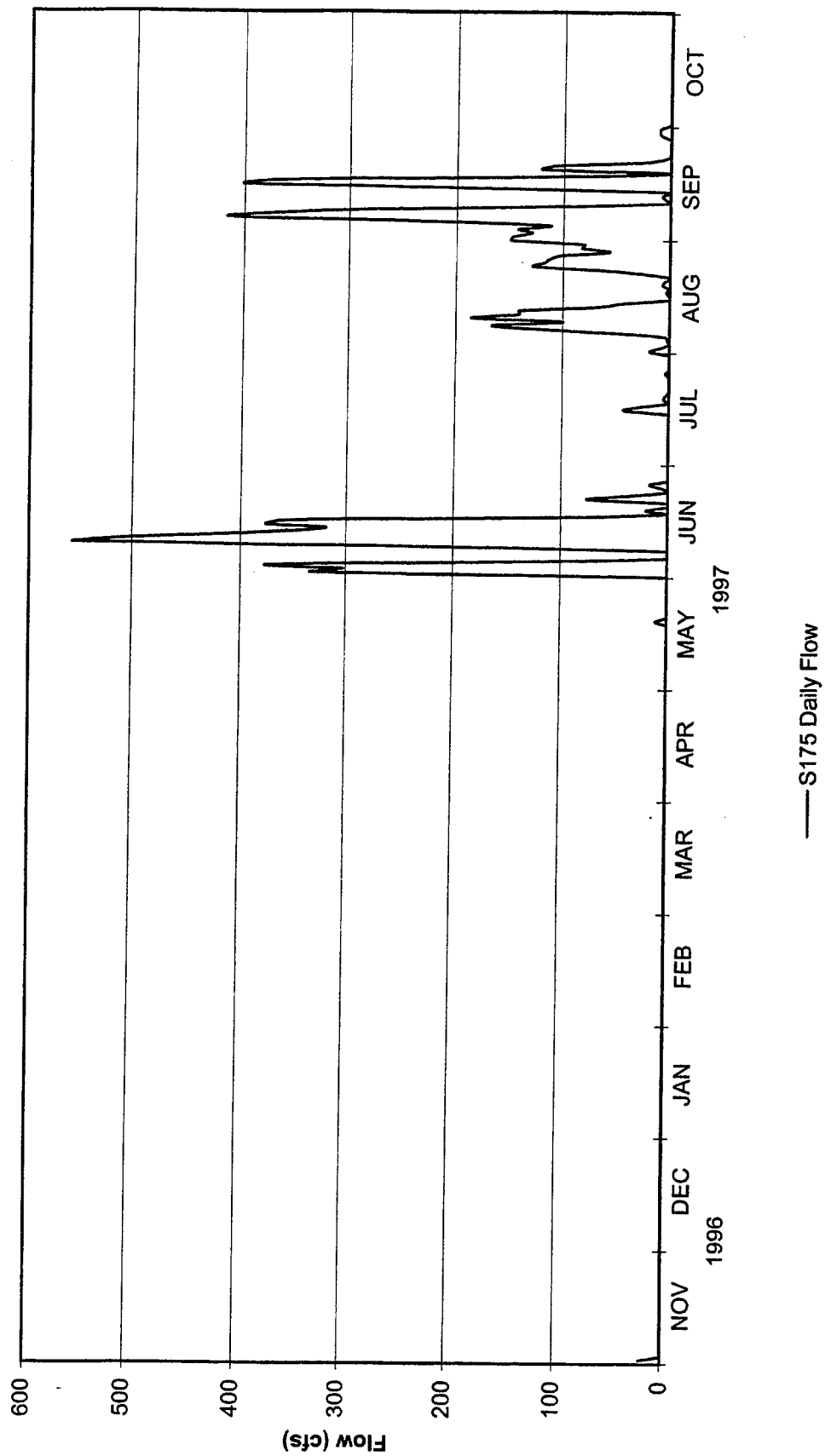


Figure 55. S-174 Ave. Daily Headwater/Tailwater Level, Year Three Test 7

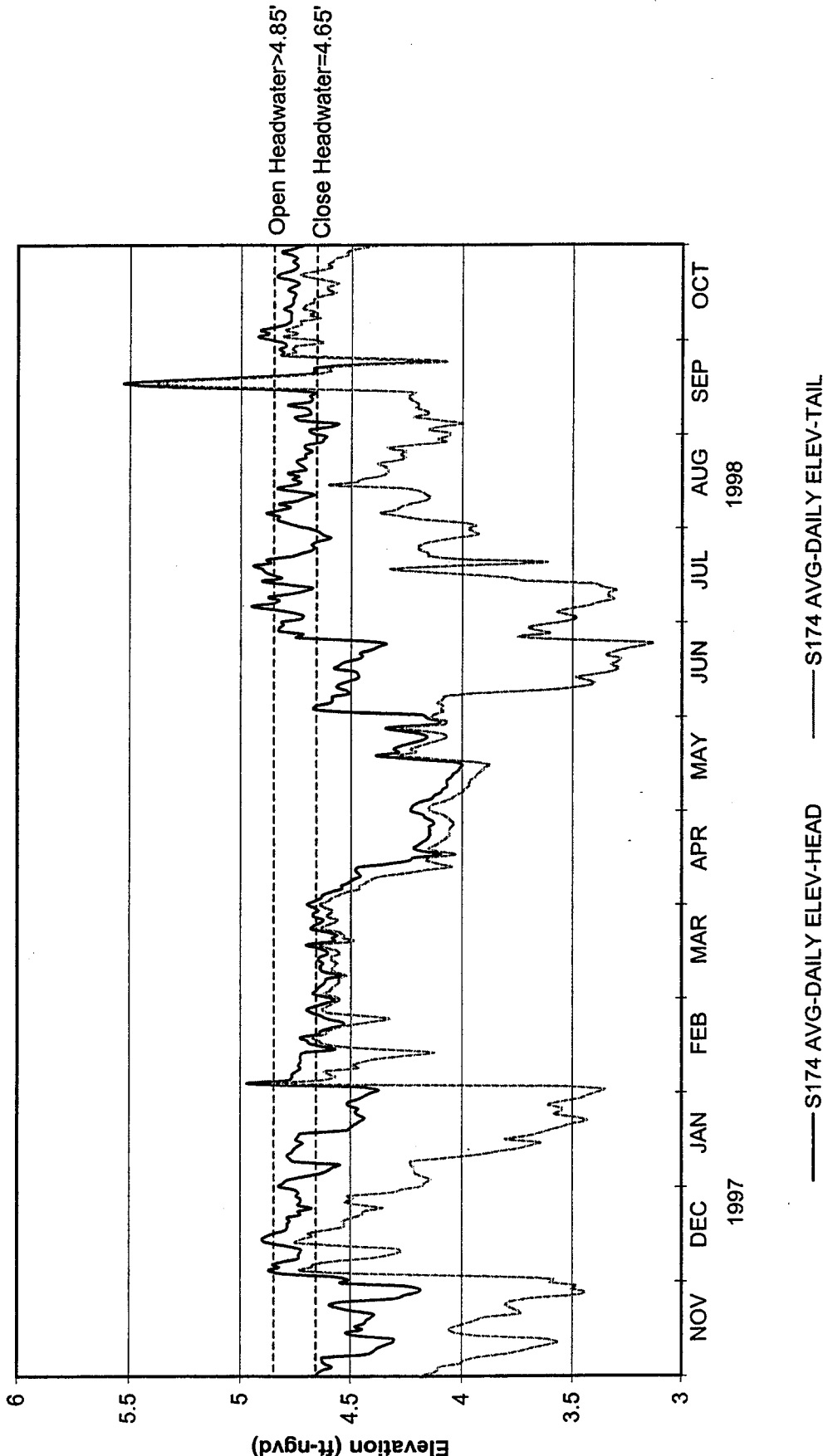


Figure 56. S-174 Flow, Year Three Test 7

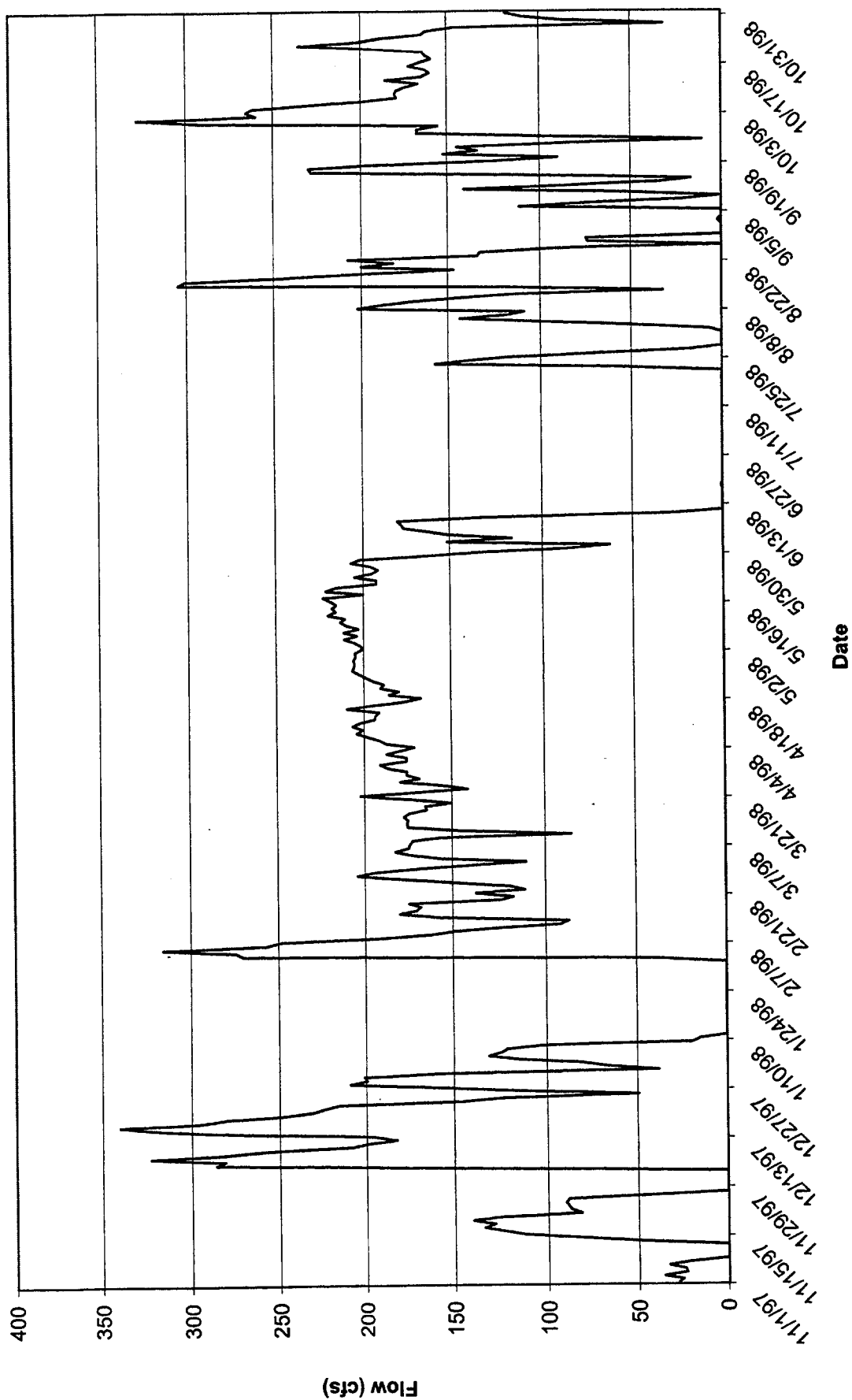


Figure 57. S-232 Flow, Year Three Test 7

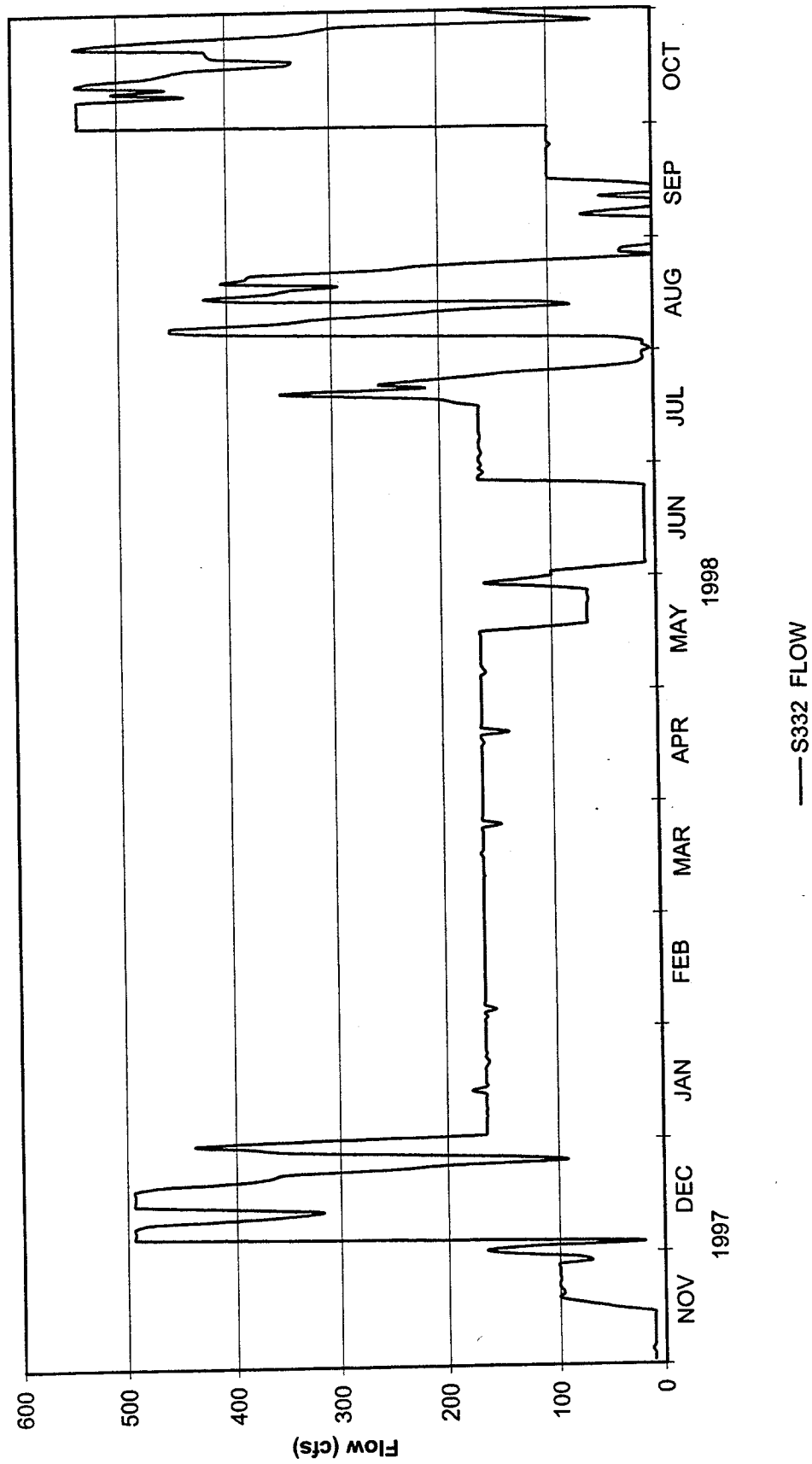


Figure 58. S-175 Ave. Daily Headwater/Tailwater Levels, Year Three Test 7

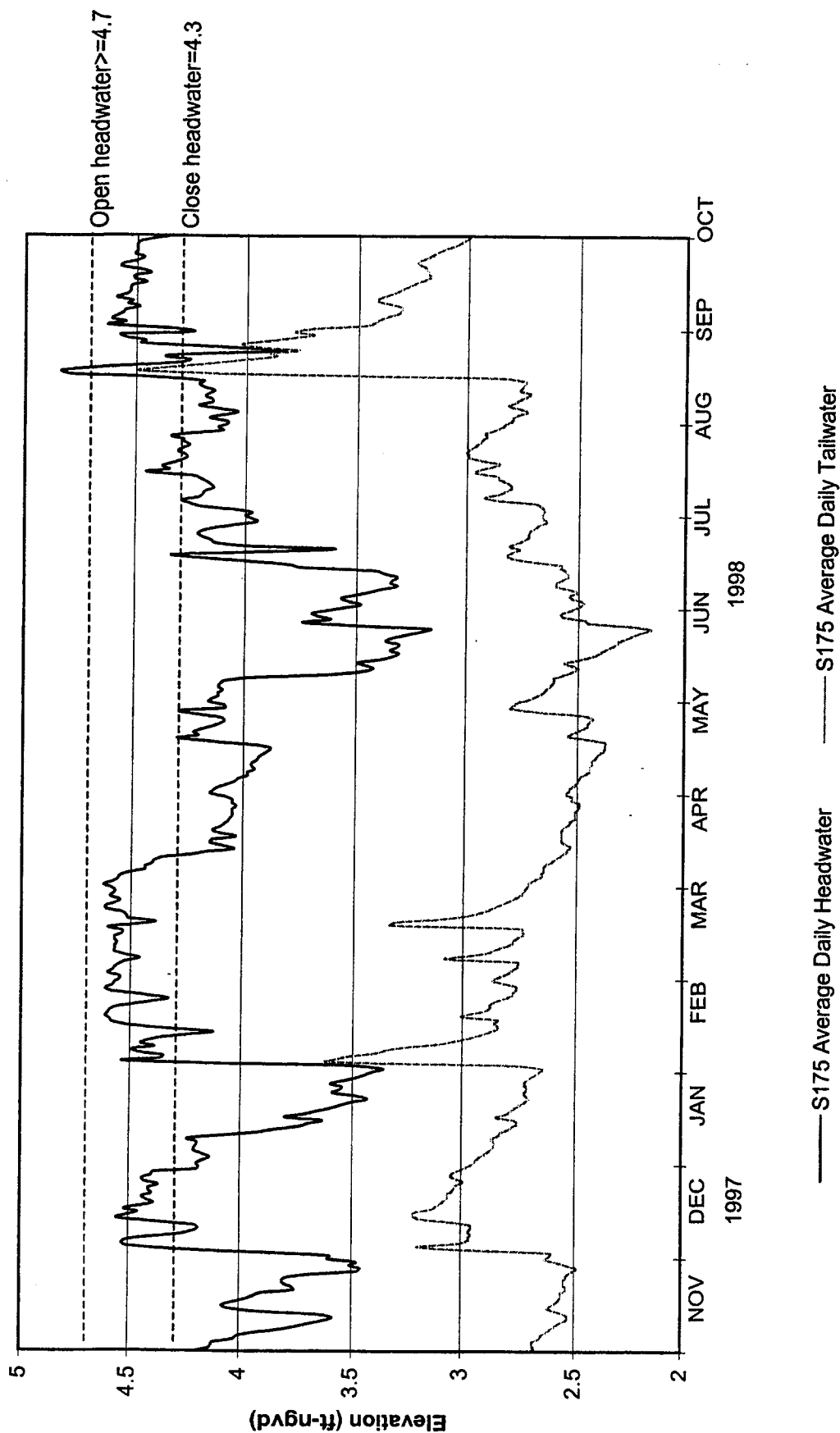


Figure 59. S-175 Flows, Year Three Test 7

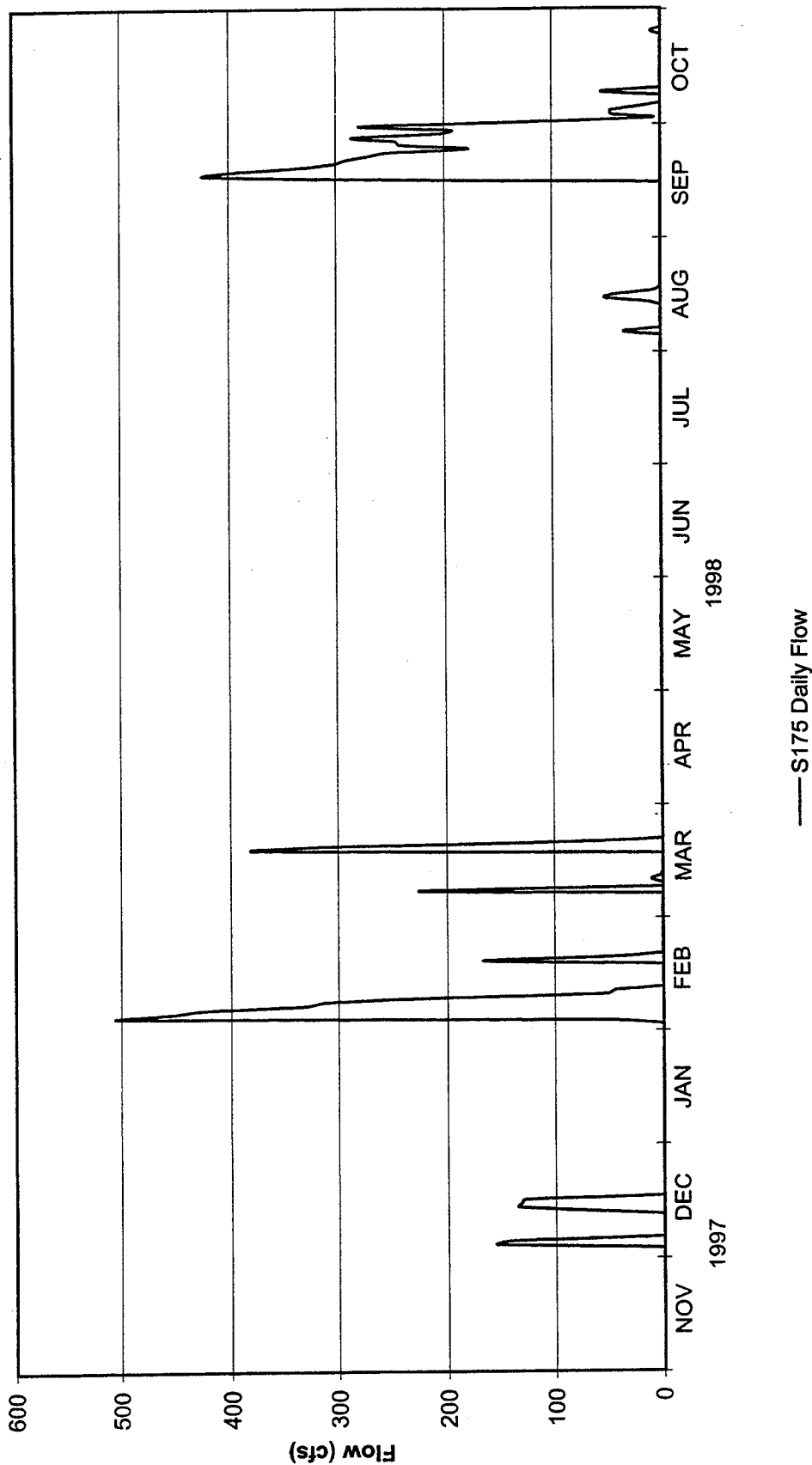


Figure 60. S-176 Flows

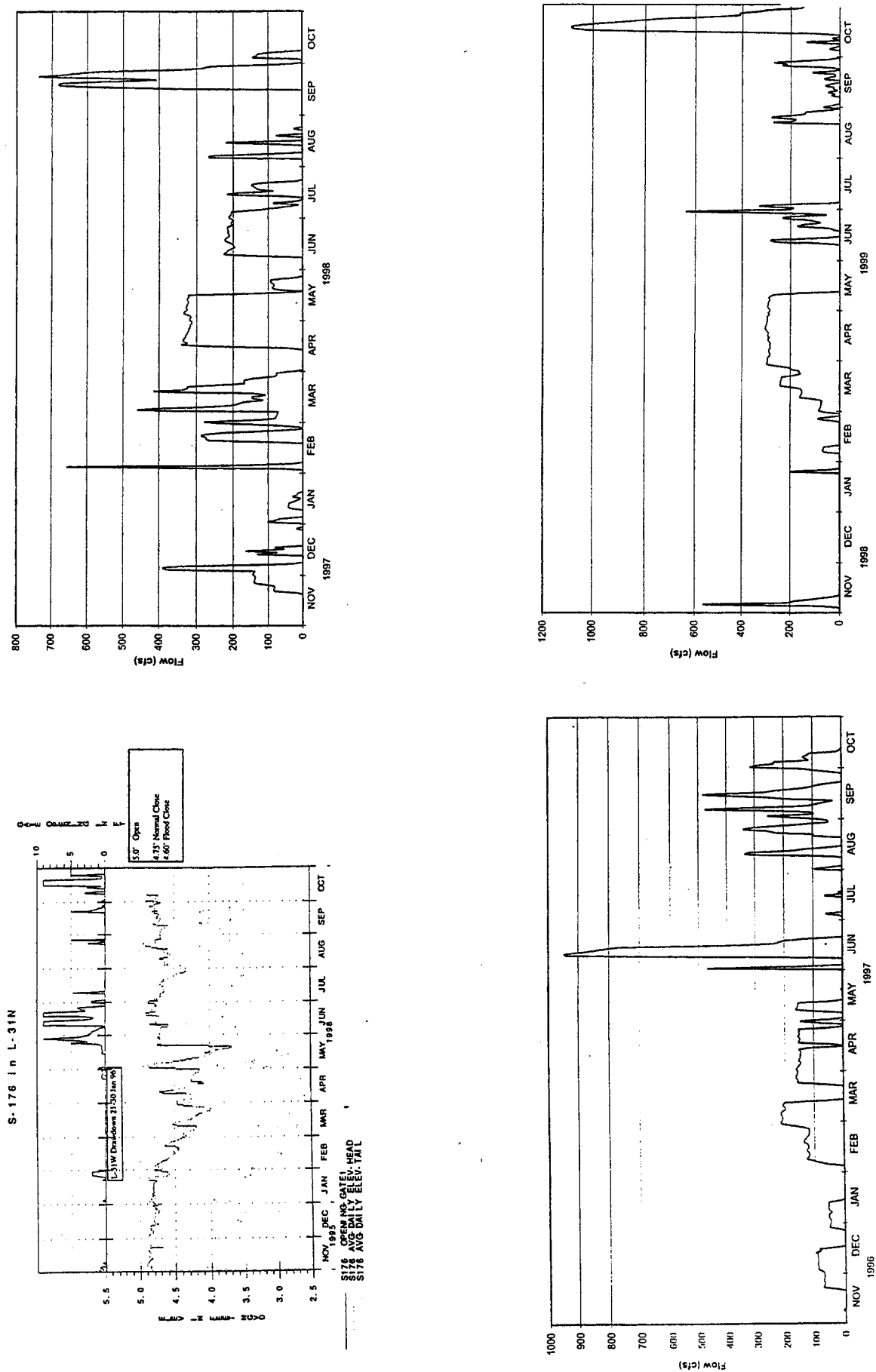


Figure 61. S-174 Flow, Year Four Test 7

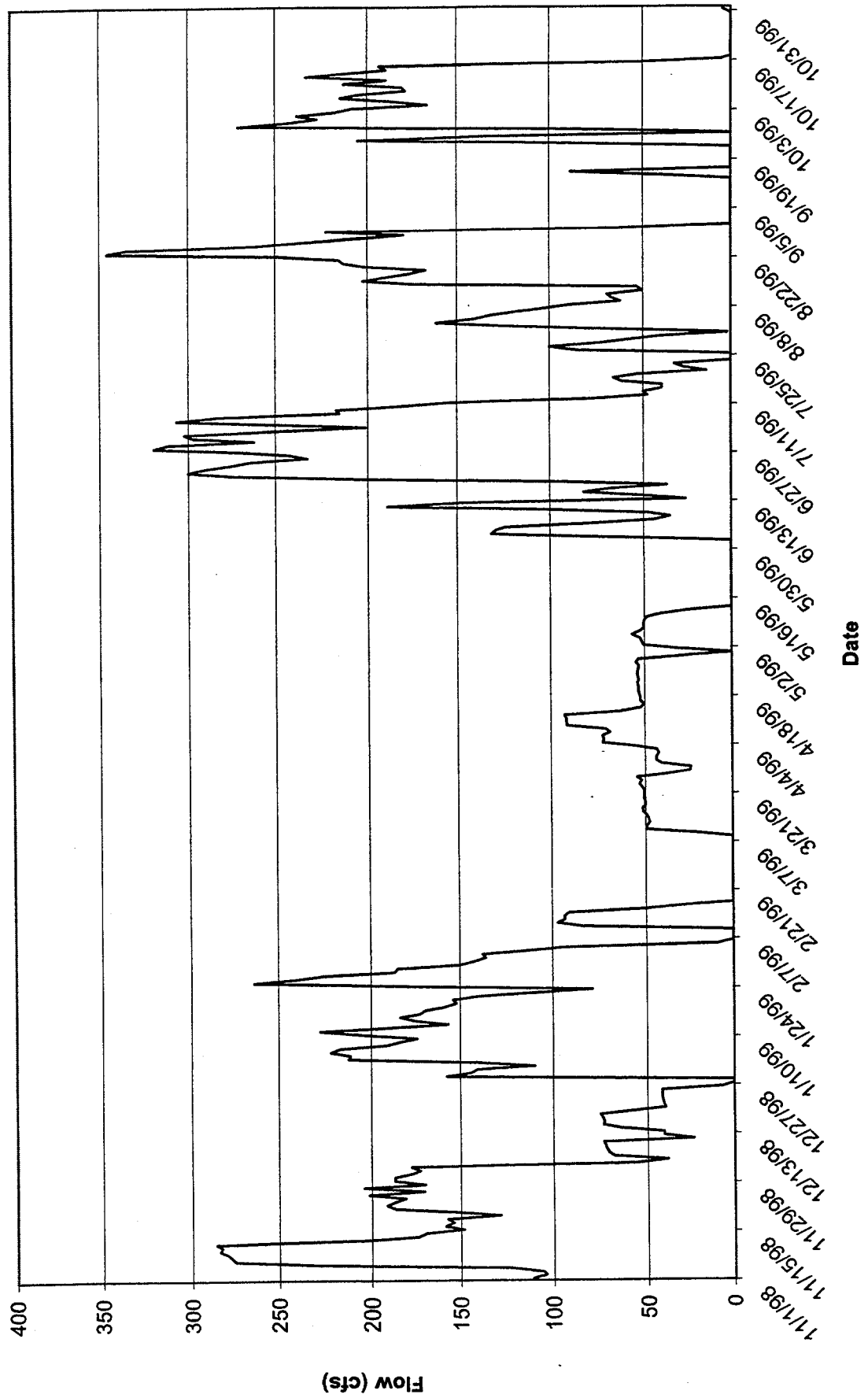


Figure 62. S-232 Flow, Year Four Test 7

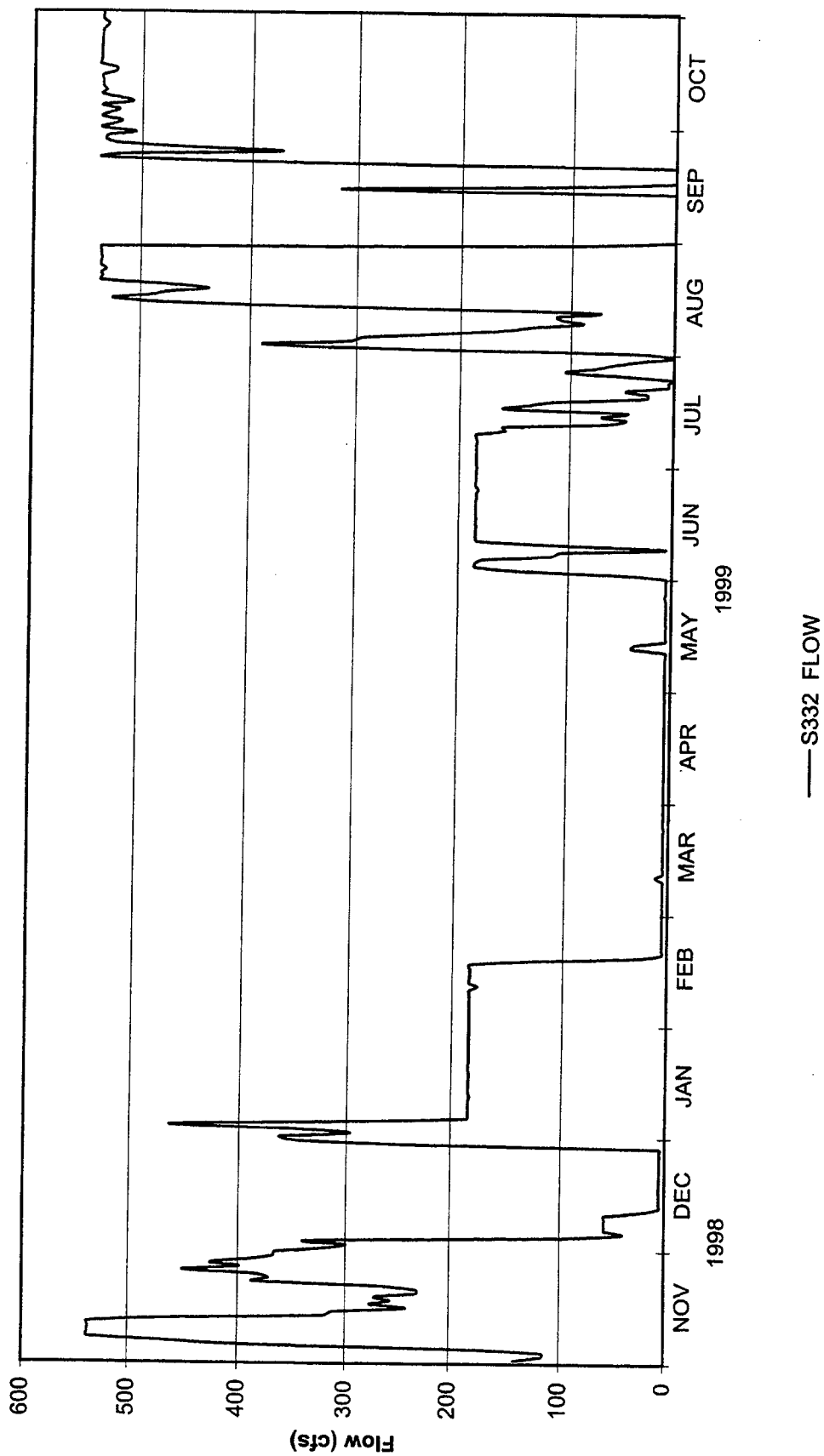


Figure 63. S-175 Ave. Daily Headwater/Tailwater Levels, Year Four Test 7

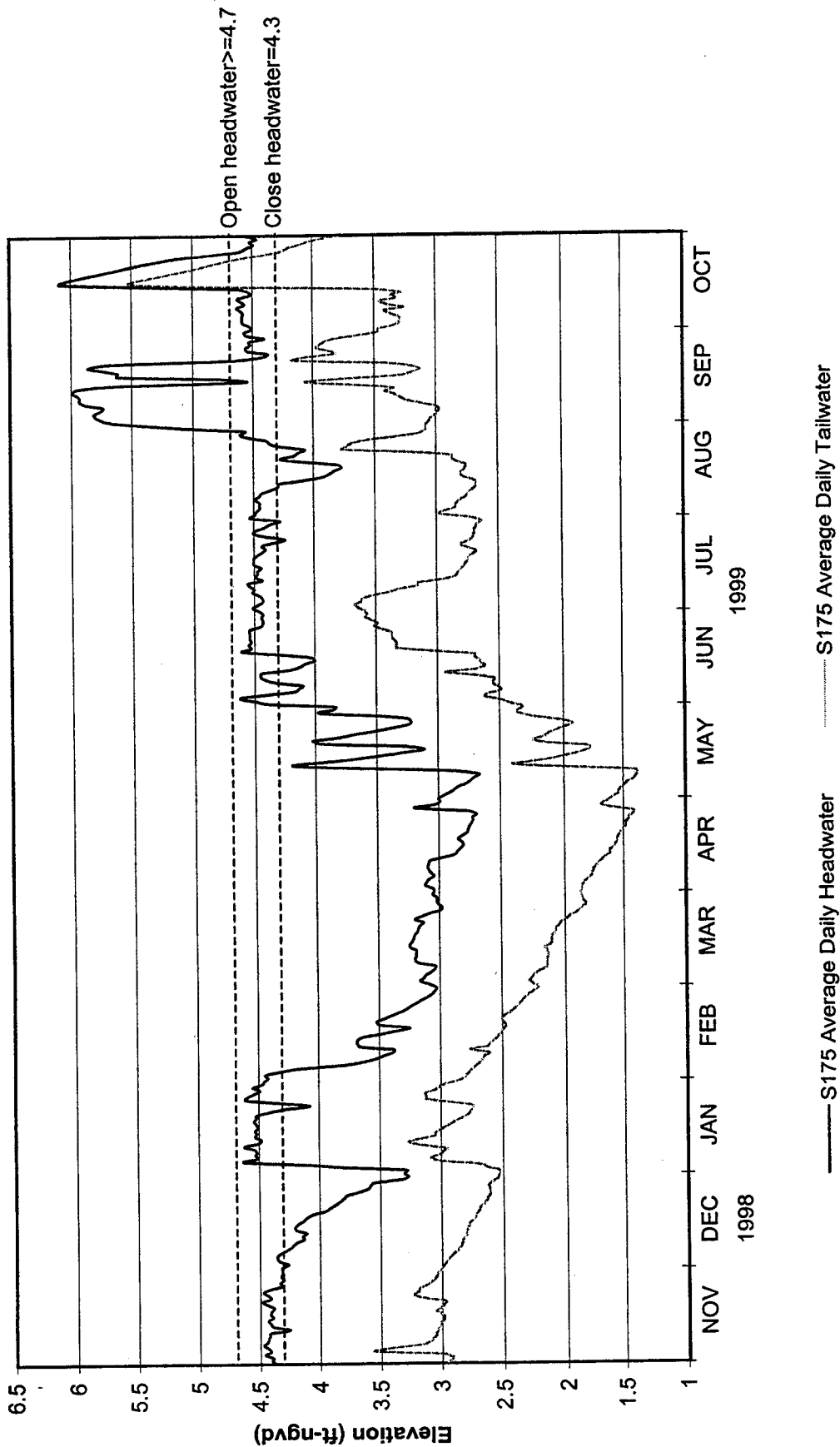


Figure 64. S-175 Flows, Year Four Test 7

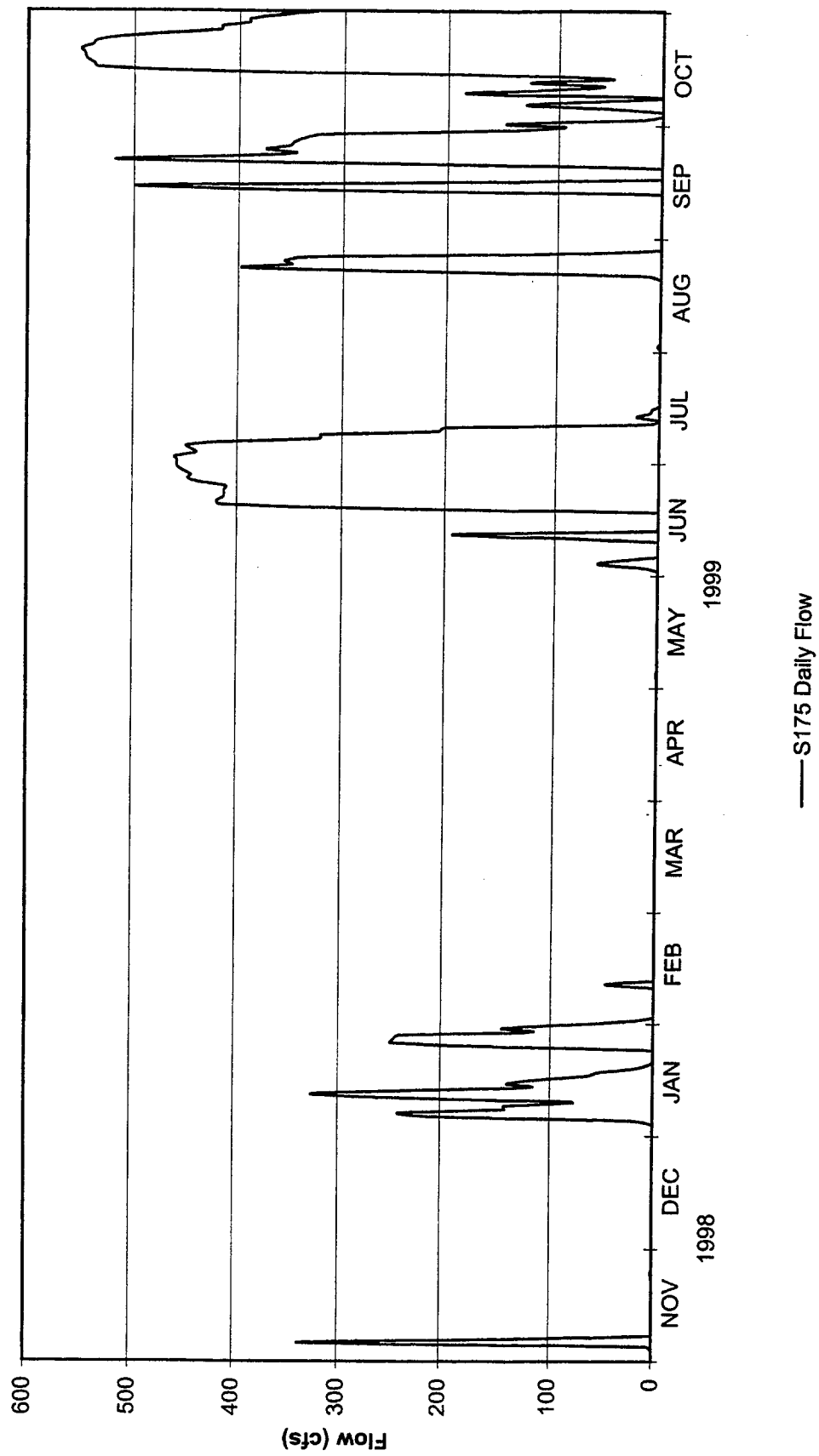


Figure 65. L-31 Target Stage 1933-1945 vs. 1970-1982

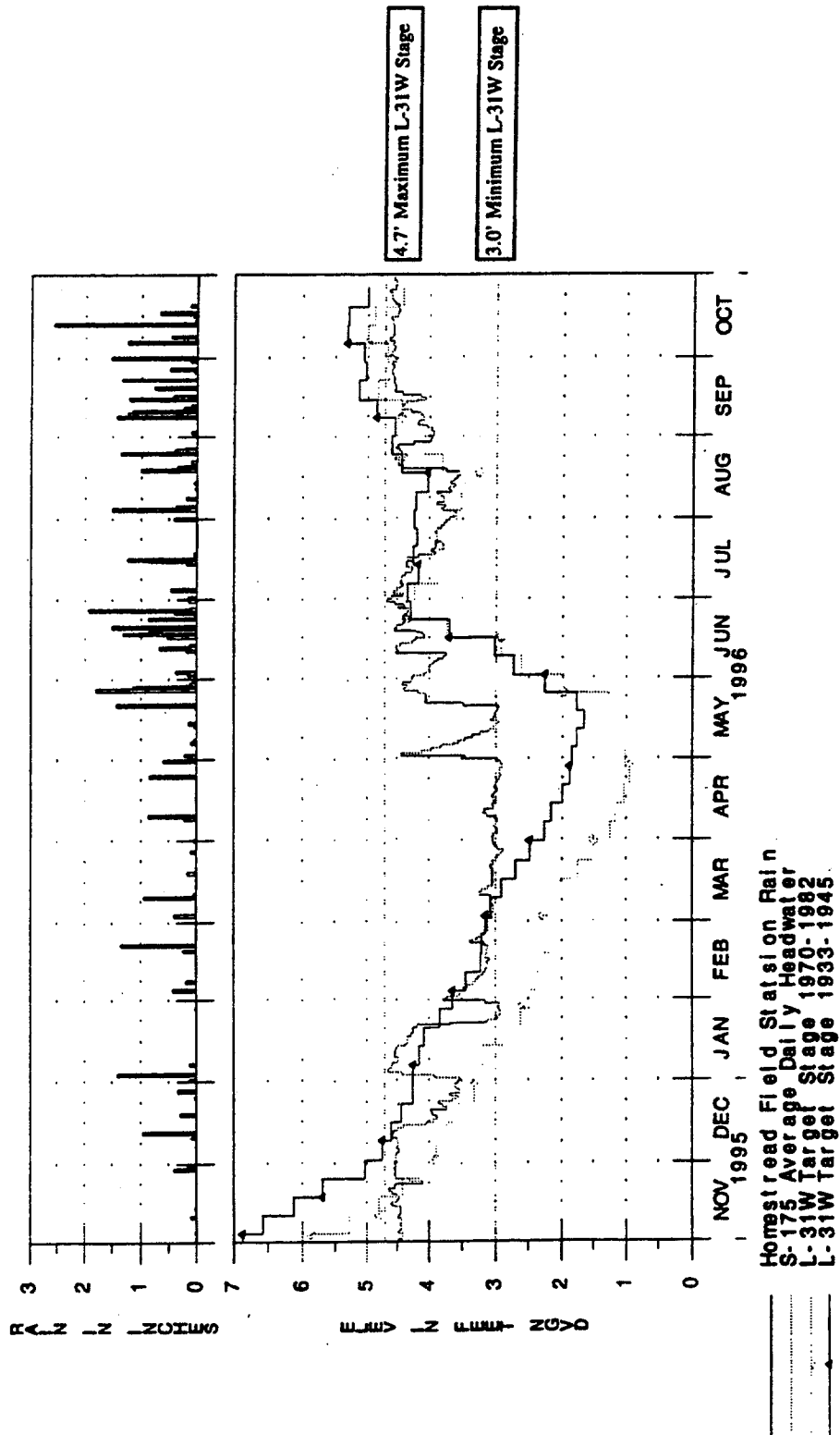


Figure 66. Marsh Gages to the West of L-31W, Year One Test 7

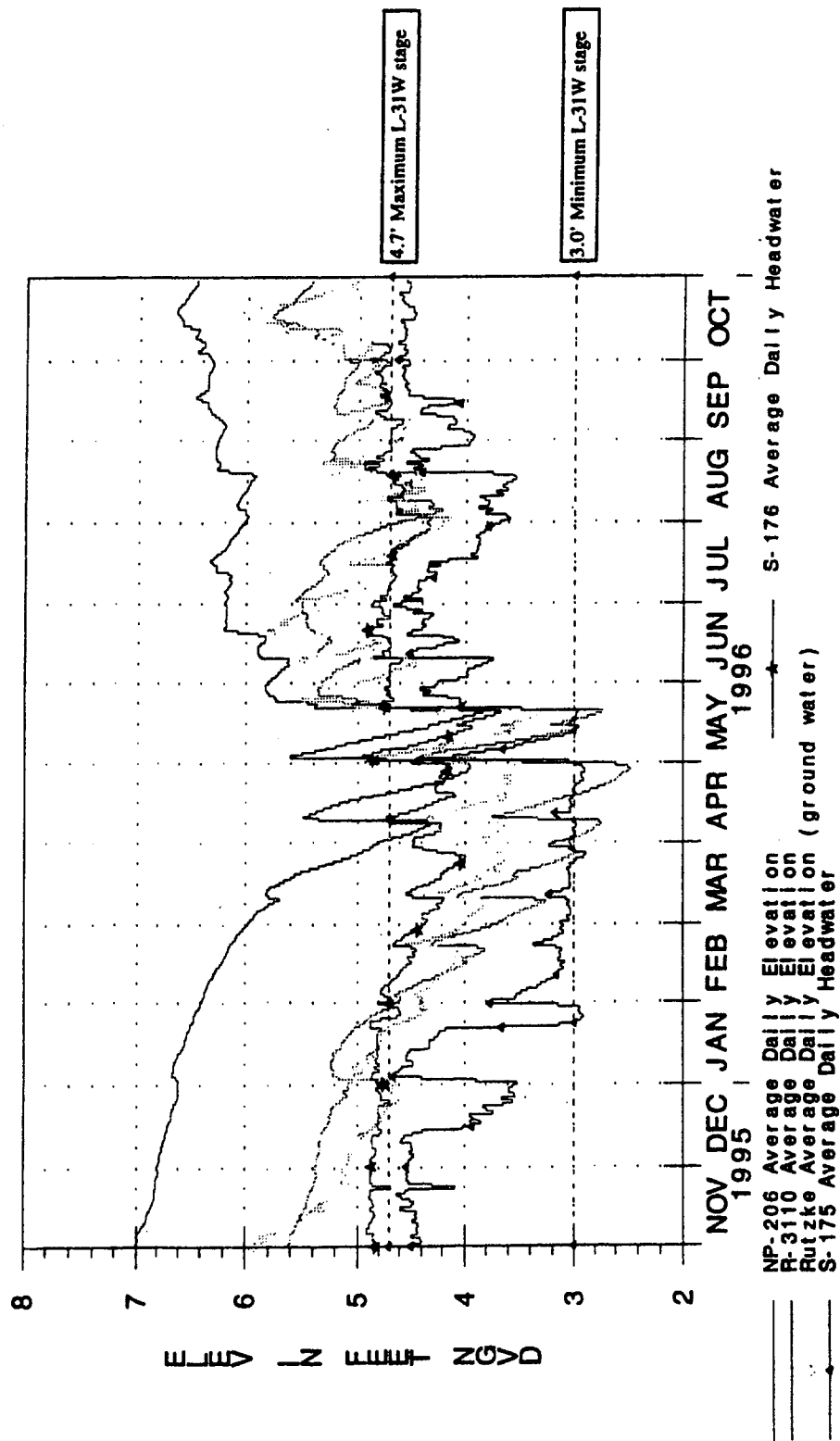


Figure 67. Marsh Gages to the West of L-31W, Year Two Test 7

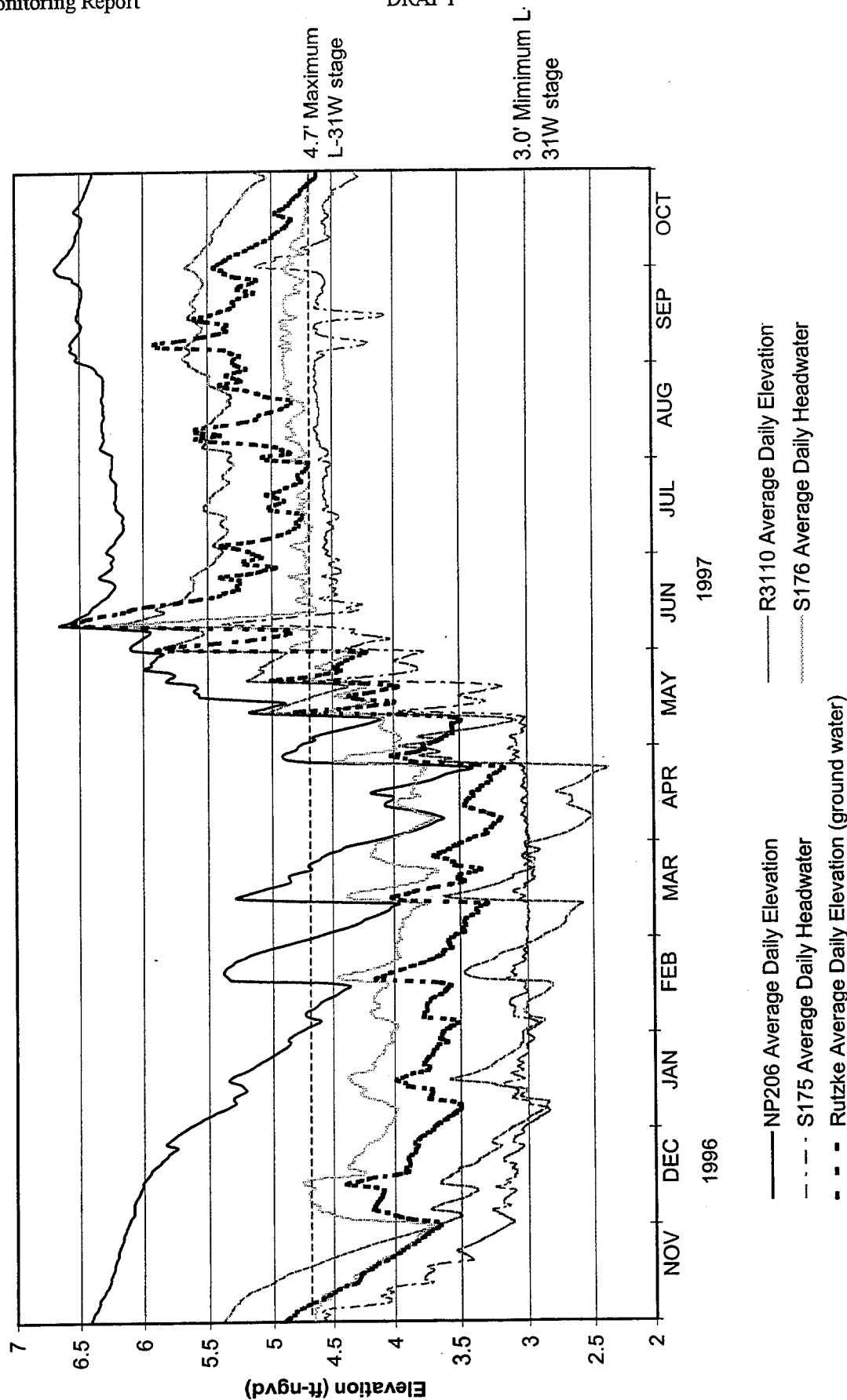


Figure 68. Marsh Gages to the West of L-31W, Year Three Test 7

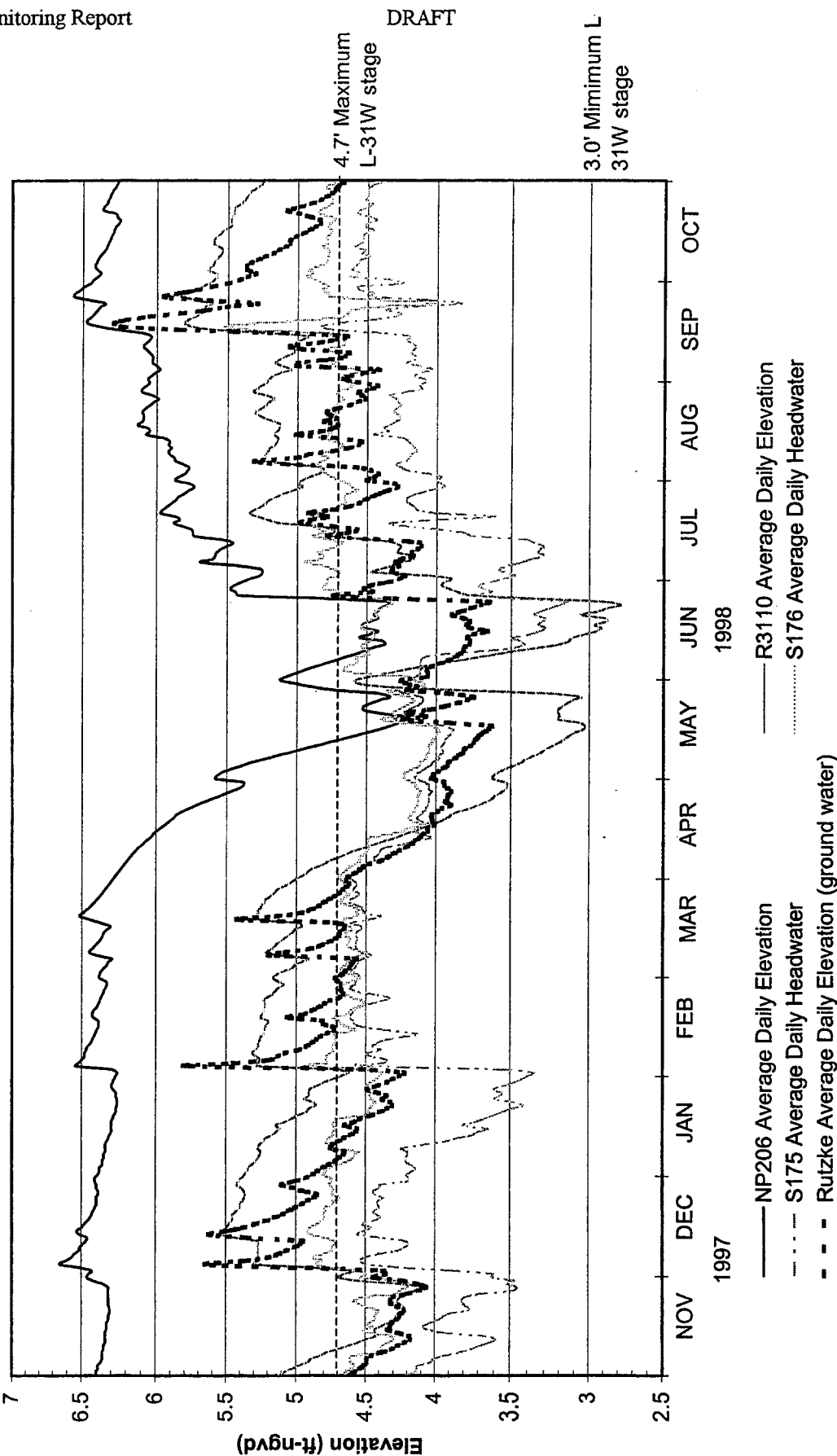


Figure 69. Marsh Gages to the West of L-31W, Year Four Test 7

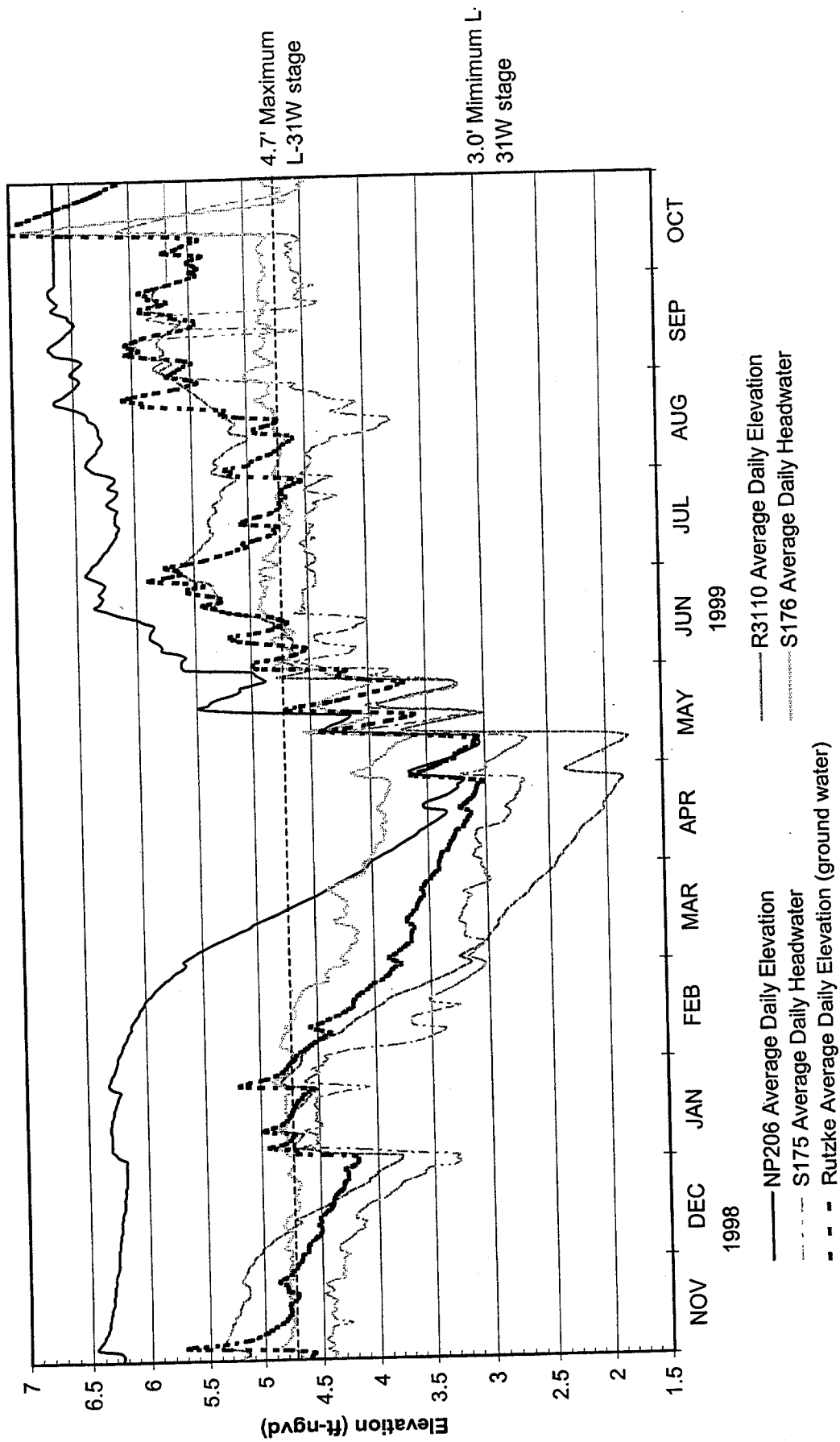


Table 12. S-174 Headwater

S-174W	November	December	January	February	March	April	May	Average	June	July	August	September	October	Average
Year One	4.82	4.79	4.78	4.58	4.47	4.35	4.3	4.58	4.75	4.62	4.70	4.75	4.76	4.72
Year Two	4.2	4.35	4.1	4.12	3.98	3.9	4.35	4.14	4.9	4.75	4.83	4.85	4.75	4.82
Year Three	4.47	4.77	4.6	4.67	4.63	4.3	4.20	4.52	4.55	4.80	4.75	4.80	4.78	4.74
Year Four	4.75	4.75	4.75	4.65	4.25	3.98	4.15	4.47	4.80	4.75	4.77	4.85	5.12	4.86

NOTE: Year One = 1996
 Year Two = 1997
 Year Three = 1998
 Year Four = 1999

Table 13. S-175 Headwater

S-175 HW	November	December	January	February	March	April	May	Average	June	July	August	September	October	Average
Year One	4.5	4.1	4.0	3.23	3.03	3.0	3.66	3.65	4.3	4.15	4.0	4.35	4.55	4.27
Year Two	3.8	3.12	3.03	3.04	3.0	3.01	3.50	3.21	4.5	4.52	4.6	4.53	4.60	4.55
Year Three	3.75	4.42	3.77	4.4	4.55	4.2	4.1	4.17	3.62	3.75	4.25	4.35	4.52	4.10
Year Four	4.40	4.0	4.35	3.5	3.1	2.95	3.35	3.66	4.35	4.45	4.35	5.25	4.80	4.64

NOTE: Year One = 1996
 Year Two = 1997
 Year Three = 1998
 Year Four = 1999

Table 14. S-196 Average Monthly and Average Dry Season and Wet Season Stage Levels

S-196 A	November	December	January	February	March	April	May	Average	June	July	August	September	October	Average
Year One	3.85	3.65	3.8	3.22	3.0	2.9	3.8	3.46	4.9	3.9	4.0	4.2	4.5	4.30
Year Two	3.2	2.98	2.9	3.0	2.9	2.7	3.15	2.98	4.65	4.0	4.4	4.75	4.9	4.34
Year Three	3.2	4.1	3.73	4.1	3.9	3.25	3.10	3.63	3.3	3.75	4.05	4.35	4.2	3.93
Year Four	4.02	3.4	3.70	3.2	2.9	2.6	2.98	3.26	4.35	4.1	4.05	4.50	5.15	4.43

NOTE: Year One = 1996

Year Two = 1997

Year Three = 1998

Year Four = 1999

C-111 Basin

C-111 BASIN

C-111 Basin (C-111) Operation Objectives During Test 7

A principal objective of the Test 7 Iteration of the Experimental Water Deliveries Program is the reduction or elimination of S-197 discharges. S-197 maintains optimum water control stages in the C-111 canal, prevents saltwater intrusion during high tides, and allows water to pass through cuts in the south spoil bank of C-111. S-197 is closed unless operating under a flood control situation and then only after established criteria are met at upstream structures. S-18C acts to maintain a desirable freshwater head against saltwater intrusion through C-111, and pass 40 percent of the standard project flood. The Minimum Monthly Deliveries Schedule P.L. 91-282 for the Eastern Panhandle remains in effect through Test 7, with specified volumes to be delivered each month.

Operational Criteria

The operational criteria for Test 7 is outlined in Table 4 (page 9). Figures 70 and 71 (pages 113 and 114) show the opening and closing criteria for S-177 and S-18C.

Difference in Test 6 and Test 7 Criteria

The operating criterion of maintaining a wet and dry season canal stage above S-176 of 5.0 ft, which was implemented during Test 6, remained the same for Test 7. At S-18C the gate was set to close when the headwater reached 2.3 ft rather than at 2.0 ft. At S-197 the closing criteria were established as follows with an additional note that during Test 7, the criteria for opening all 13 culverts would be reviewed for opportunities to make modifications:

Test 7 Closure criteria for S-197 requires the coincidence of the following three items:

- Headwater at S-176 has declined below 5.2 ft-NGVD and headwater at S-177 has declined below 4.2 ft-NGVD. Note that stage levels above these levels trigger mandatory flood control releases. A declining trend in water levels below this stage would indicate the peak of the storm has passed.
- Position of the storm has moved away from the basin.
- When conditions 1 and 2 are met only the number of culverts required to match the residual discharge through shall remain open. All culverts would be closed once the headwater stage decreased below 4.1 ft.

C-111 Summary of Operations

Wet Season 1995. During June 1995, 12 gates were opened at S-197 then reduced to three by the end of the month. Again in July, 13 gates were opened at S-197 and remained open into the first week of August. Heavy rainfall associated with Hurricane *Erin* the first week in August and from Tropical Storm *Jerry* the last week in August resulted in S-197 being operated twice during August for flood control purposes. Rainfall activity continued through October and Structure S-197 was opened September 12-16, 1995, September 16-October 1, 1995, October 10-

November 1, 1995. Flood control pumping at S-331 and S-332 was maintained whenever there was downstream capacity. WCA-2 and WCA-3 were all above schedule during this time. Lake Okeechobee and WCA-1 were above schedule during October and declining going into the start of Test 7.

Year One Test 7. Flood control pumping at S-331 continued through January 24, 1996. Water supply delivery to the South Dade Conveyance system began in February and releases were made through S-18C to meet minimum deliveries.

May was the transition into the wet season and flood control pumping at S-331 began May 28 and continued through July 22, 1996. Gravity releases were made through S-331/S-173 from July 22, until August 21, 1996. Flood control pumping at S-331 resumed on August 22 and continued through September. With the transition into the wet season, operations at L-31W were modified by closing S-174 so as not to cause S-175 to open due to concerns over a nesting sub-population of CSSS. The criteria at S-176 was changed from opening at 5.0 to 4.85 ft in May and returned to Test 7 criteria on June 21, 1996, when the USFWS and ENP determined that the CSSS had completed their third nesting cycle. S-197 was opened twice during June. Flood control pumping at S-331 continued through the end of October. Due to rainfall during the first week of October and the threat of Hurricane *Lili*, operations at S-176 were modified so that headwater was set to open at 5.0 and close at 4.0. This occurred from October 15 to October 21. S-197 was open from October 12 to the 23.

Year Two Test 7. At S-177 Year Two began with the headwater stage level just below 4.0 feet (see Figure 72, page 115). This was different from many of the other gages discussed because most of them began in November above the maximum operating level. The level receded below the minimum level before the month was over and except for a spike rise in mid-December remained around 3.0 feet until mid-May. This is what would be expected considering the dryness of the dry season. In mid-May the stage level began to rise and by June 1 had reached 3.6 feet, the minimum stage level. A sharp spike in the stage level occurred in mid-June. After that the stage level isolated between the maximum stage level of 4.2 feet and the minimum stage level, which is 3.6 feet. Flow through S-177 occurred almost all month (see Figure 73, page 116). The largest non-flow period was from mid-January and early February. There was a break in flow also in the first two-thirds of November. Since the dry season was indeed dry the flow in the dry was mostly water supply.

The S-18C structure operates in a narrow stage band, 2.6 feet maximum and 2.3 feet minimum (see Figure 74, page 117). In Year Two, the stage level went below the minimum level just after the middle of November. The level did go back above the minimum briefly in mid-January but receded slowly back to a low in late April. From that point, the level rose back to the minimum level by June 1. There was a rain event in mid-June and the level went above the maximum. The level came back into the maximum and minimum range before June was over and isolated in that range the remainder of the wet season with exception of some isolated spikes in the level in September. The flow was minimal through May (dry season) (see Figure 75, page 118). There was constant flow in the wet season from June through October. A significant spike in the stage level occurred in June as a result of a rainfall event.

Year Three Test 7. Year Three began at the minimum stage level of 3.6 feet. The dry season for year was wet and the stage level reflects this since it is much higher than it was in Year Two, particularly in December, January, and February. The stage level receded in March and again in April to a level even lower than in Year Two but the overall stage level for the dry season was above average. The stage level rose rapidly in early June due to a significant rain event. The level reached the minimum level quickly and the stage isolated between the maximum and minimum level quickly and the stage isolated between the maximum and minimum level the remaining part of the wet season. Flow through S-177 was similar to Year Two in the dry season except for the two month period from early April, when the stage level lowered rapidly below the minimum, through May and into early June just before the rain event (see Figure 76, page 119). During this time there was consistent moderate to high flow. This was apparently due to water supply. In Year Three, which was a wet year particularly in the dry season, the stage level at S-18C actually operated within the maximum and minimum level all year (Figure 77, page 120). The exceptions were a small spike in early February, some very minor excursion above the maximum in late May and early June, and a major rain event in September. There was a dip in the level in June, which carried the level below the minimum for a couple of weeks. Flow through S-18C was higher than the previous year but this should be expected considering the wetter conditions (see Figure 78, page 121). There were several spikes in the stage hydrograph. A spike occurred in December, several in February and March, another in August and a major spike in September.

Year Four Test 7. In Year Four, the stage began just above the minimum level and remained above this level until early December (Figure 79, page 122). The level dropped below minimum during December but rose the first of January above minimum and isolated between the maximum and minimum until early February when the level again dipped below minimum. The level receded to near 3.0 feet and remained in that area until May. In May, true to the nature of this transition month rose and exceeded the minimum level June 1. The level isolated between the maximum and minimum level until a major rainfall event in mid-October. Flow during the dry season was pretty much minimal (Figure 80, page 123). Flow was consistent from mid-August until the major rain in October when the flow increased sharply. In Year Four the stage level for S-18C began at the maximum level but isolated between the maximum and minimum through November, December, and January before receding to its dry season low in April (see Figure 81, page 124). From this point, the level began to rise and by June was back between the maximum and minimum levels. There were some heavy rains in September and again in October so the level operated at or slightly above the maximum level more than usual in August, September, and October. Flows through S-18C were low in the dry season with the exception of a spike in early November (Figure 82, page 125). As one would expect the flow were higher on the wet season. A major spike occurred in October as a result of a major rain event.

In years Two, Three, and Four the stage levels for S-197 are a mirror image of S-18C (see figures 83, 84, 85, and 86, pages 126 - 129). There is no maximum and minimum stage level or any desire to control the headwater other than the control exerted by S-18C by virtue of location. The concern at S-197 is the discharge of flow. The desire is to minimize discharge through S-197 and maximize discharges to the eastern Panhandle and South Florida. For Year Two, there was flow associated with the rain event in June. There was flow indicated in mid-September, which is indicated to be consistent through early December of Year Three. There is no association with a rainfall event therefore this is questionable. There is flow in September of Year Three and this flow is in association with major rain in September. There is a minor flow indicated in early November of